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THE JOURNAL OF THE NATIONAL DENTAL ASSOCIATION

1922

Compensatory Treatment for Missing Teeth—*Gray*

Surgical Preparation of the Alveolar Ridges —*Giffen, Rogers, Kemper*

The Radiogram and Its Interpretation —*Lamphear*

Mastication in Relation to the Periodontium —*Hirschfeld*

Financing Mouth Hygiene—*Wilson*

More Efficient Denture Service—*Dittmar*

Oral Diagnosis—*Best, Waldron*

Action of Solutions Upon Tissue Cells —*Nichols*

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The Physician and the Dentist—*Editorial*

NATIONAL DENTAL ASSOCIATION MDCCCXCVII

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M. E. GROSSMAN, D.D.S.
1859–1921

THE JOURNAL
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Original Communications

A FURTHER STUDY IN COMPENSATORY TREATMENT FOR MISSING TEETH

By B. FRANK GRAY, D.D.S., San Francisco, California

(Read before the National Dental Association, Milwaukee, Wisconsin, August 15-19, 1921)

THE PROBLEM of compensatory treatment for missing teeth is not solved. A few score of prominent orthodontists have contributed of their knowledge and opinion to the study of the matter, however, and we are indebted to them. A whole volume might be written on the subject at this time and still we would not reach an altogether satisfactory solution. I have noted in a few instances that those returning the questionnaire on the subject have determined upon methods of treatment quite satisfactory to themselves. On the other hand the majority of orthodontists confess overwhelming perplexity in the matter.

The etiology of congenitally missing teeth baffles the understanding of all students. Possibly that is one of the reasons it holds our interest so fully.

Orthodontists are noting in their practice the absence of certain permanent teeth—from one to six being rather commonly reported as congenitally missing.

In order that we may not start any contest as to which one among us has discovered the most striking example of anomalies of this character, it may be interesting to note the case reported by Thorwald Kjaer, of Copenhagen, in 1906. In a patient twenty-five years of age five deciduous teeth were found, but radiographs proved that neither the germs of any of the permanent teeth, nor the teeth themselves were present in the jaws. (It is assumed, of course, that

none of these permanent teeth had ever been present and subsequently lost.)

But for the purposes of this study we are not to forget that teeth are missing from several causes. Especially at this time are we harvesting a crop of so-called "dead teeth"—condemned because of presumed or real focal infections, even in early youth. Fortunately the gross neglect of the first permanent molar that used to be so common is noticeably lessened, so that this most useful tooth is not so often sacrificed as formerly. However, many of us have some patients in whose mouths the first permanent molar has wholly gone to pieces in childhood, thru sheer neglect.

It is just as well to face the problem as it really exists at the outset. Thus we shall have to admit that once a permanent tooth is missing from the dental arch, from whatever cause, it is no longer possible to secure normal conditions or relations in that individual's mouth. From that time forward any contemplated procedure whatsoever is relatively compensatory only. To compensate means to substitute in full, measure for measure. It therefore resolves itself into a selection of that method which will bring to the patient thruout his lifetime the best aesthetic result—the best practical result, and the one with fewest objections from the standpoint of mouth hygiene.

Certainly no prosthetic appliance can wholly compensate the loss of a permanent tooth, nor can any other procedure restore the dental arch to its ideal status. I have much respect for the degree of mechanical perfection with which certain forms of bridge-work and partial dentures are being made. Such work is a great credit to the skill and ideals of many of our prominent dentists. However splendid these restorations are, they cannot be regarded as true substitutes for the natural teeth.

From the standpoint of aesthetics and hygiene there is therefore much left to be desired in the methods just referred to. I am sure I would greatly prefer in my own mouth that the loss of one or more permanent teeth should have been compensated by the early substitution of teeth posterior to the space of the missing organs—thru their forward movement, than to be compelled to wear during my lifetime an appliance of any sort whatever. If I entertain this feeling in my own behalf how much more desirable it is, then, that some of my young patients shall be spared a procedure that I would not desire for myself!

We must remember that our patients develop into men and women of refined sensibilities—sometimes to a marked degree, as in the case of vocalists, devotees of the stage, stars of the movie screen—persons to whom no ordinary fortune would be a temptation to accept artificial substitutes for the natural dental organs. The only period in life when such a result may be prevented is in youth—the period when the individual has no judgment of his own, and, in fact, no choice in the matter. Indeed, the parent or guardian is abjectly dependent upon the advice of the dentist or the orthodontist. Those who believe it wise to close up the spaces of missing teeth by orthodontic procedures are not doing so in the delusion that they are saving themselves any labor. If labor-saving were the motive certainly the course of least resistance would cause them to advise prosthetic substitutes in all such cases.

However beautifully the substitution is accomplished by the prosthetist, however efficient it may be in fact, there is an innate abhorence very often of that which is not part and parcel of one's own natural dental organs.

Let us not, therefore, lightly do for our patient that which we would not do for our own beautiful daughter, keeping

ever in mind the fact that in the child we cannot forsee her future.

Some of the respondents to the questionnaire have predicated their whole procedure on the belief that the compensatory forward movement of posterior teeth to fill spaces of missing teeth, precludes the possibility of normal occlusion—involving abnormal stress relations, etc. As already stated, all orthodontic, in fact all dental, procedures are but partially compensatory, and are ideal only in a relative way.

Incidentally, it is paradoxical that many orthodontists who clamor loudly for the merits of this or that procedure on the pretext that it alone measures up to the ideal requirements spend the years of their adult lives with most imperfect conditions existing in their own mouths. Malocclusion to the point of real deformity some of us exhibit in ourselves. It is an awful warning to humanity. "Dead teeth" in plenty we tolerate. We prefer the spaces occasioned by the loss of teeth in our own mouths to the artificial substitute, even when the magnificent creations of prosthetic art are available! Still it is to the credit of orthodontists that they do not tolerate such conditions in their patients, knowing full well how far removed from the practical and ideal is such a status.

Briefly speaking, I believe a missing second bicuspid in the mandibular arch can be very well compensated by the forward movement of the first permanent molar. In like manner a missing first permanent molar may be compensated by the forward movement of the second permanent molar. However, in case the

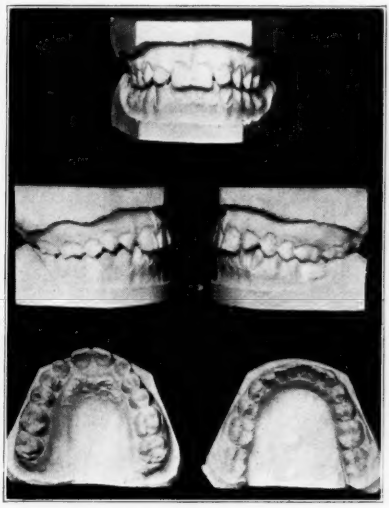

Fig. 1.—An interesting case of natural compensation for missing lateral incisors.

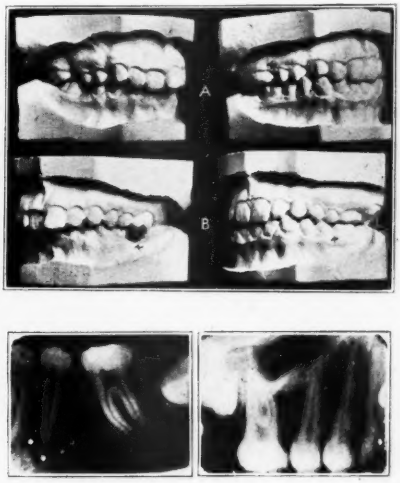

Fig. 2.—*a*, Mutilated case. Maxillary right second molar substituted for first molar extracted, mandibular right second biscuspid having erupted in the meantime. *b*, Mandibular left second molar substituted for first molar extracted. *c*, Radiographic study of this case, showing axial relations of maxillary second molar after its movement forward; also the relations of the mandibular second molar under similar conditions. In each instance the developing third molar may be observed.

third molar is absent the second molar had better remain in its normal position and the prosthetist be called upon to make a suitable restoration. Otherwise the shortening of the arch would possibly be the greater of the two evils. Even with two approximating bicuspids missing I think we might be justified in the forward movement of the molar teeth, in case all three of them are present. However, in such a case we would weigh well the matter of the age of the patient, and the practicability of the procedure for the case in hand.

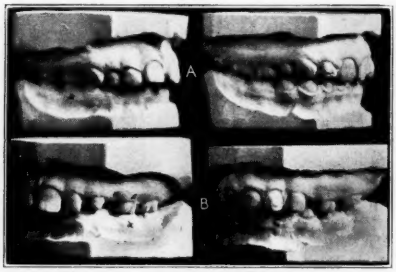

Fig. 3.—*a*, Teeth congenitally missing in maxillary arch right second bicuspid and left first and second bicuspids. (Right first bicuspid impacted.) *b*, Teeth congenitally missing in mandibular arch,—the second bicuspid of either side. Mandibular second deciduous molars were removed and first permanent molars moved forward to compensate for missing bicuspids. Maxillary left bicuspids to be supplied by bridge-work. Impacted maxillary right first bicuspid released and guided to place. Maxillary right second deciduous molar retained as substitute for the second bicuspid. The treatment was incomplete.

What I have said relative to the bicuspids and first molars applies equally well to the maxillary and mandibular arch.

Doubtless in some instances deciduous molars which have no successors might better be retained in the arch than to remove them with a view to moving into their places bicuspids or molar teeth, as the case may be.

However, if root resorption is under way, as shown by radiographs, the deciduous molars had better be replaced by the means already suggested in this paper.

Lateral incisors are frequently congenitally missing. At a suitable treatment age I would compensate their loss by the forward movement or development of the teeth posterior to the laterals. Particularly is this desirable in the maxillary arch, and especially so when the patient is a girl. It is true that cuspid teeth may not look well in juxtaposition to central incisors. However, they very often lend themselves to such reshaping and polishing that they may be made to resemble the lateral incisors. Again, in those cases where the cuspid is so distinctly canine in its appearance that it is not adapted to the treatment suggested, a competent specialist may do some beautiful porcelain jacket crown work, and the end attained will very fully justify the procedure.

In the case of missing lateral incisors in the mandibular arch I am not sure that this procedure would be the one of general choice. In one case just now under treatment I have opened the spaces preparatory for bridge-work, since I disliked to interfere with the very excellent occlusion in the bicuspid and molar region on either side. While very far from ideal, bridge-work would be much less objectionable in the mandibular arch than in the maxillary arch.

An interesting case of natural compensation for missing lateral incisors is shown in Figure 1. Without orthodontic assistance the cuspids and all of the buccal teeth of the maxillary arch have found their way forward, because of the congenitally missing laterals. With the exception of some rotation of one of the cuspids and the prominence of a bicuspid, there is little to be desired in this case. The facial balance is most excellent. In fact the patient is really a beautiful

young girl of approximately fourteen years of age. This case emphasizes, I think, the correctness of my suggestions as to the treatment where maxillary lateral incisors are missing.

Methods of Tooth Movement

An outstanding feature in moving teeth from a "distal" part of the arch to a more or less anterior position to compensate for missing teeth is that they must be maintained as nearly as possible in an upright position. Therefore the suggestions made by some of the respondents to the questionnaire have taken this into consideration. Thus Dr. Bowman of Pittsburgh, suggests the use of the Angle "pin and tube" appliance.

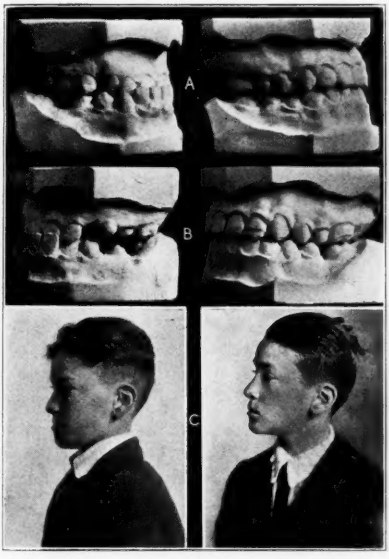

Fig. 4.—*a* and *b* illustrate substitution of mandibular second permanent molar on either side for the extracted first permanent molars. (Class III mutilated). *c* illustrates the characteristic facial inharmony of Class III cases, and the improvement following orthodontic treatment. (Treatment nearing completion.)

Drs. White of Detroit and Cavanagh of Portland, Oregon, have made similar suggestions, as have other orthodontists. By this method a practically stationary anchorage may be secured anterior to the space to be closed, thru attachments to two or more teeth. The closing of the loops from time to time, as indicated, makes of this a relatively positive procedure.

Dr. Grieve, of Toronto, employs half-round tubes and the corresponding half-round wire in this work. He calls attention to the possibilities of rotation where this modification of the appliance is employed. Dr. Grieve uses this half-round wire and tubing wherever he uses the "pin and tube" appliance, and I believe the treatment of many of his patients is beautifully accomplished by this method.

Thru the use of root-wise contraction bars, placed on the teeth both lingually and bucally, Dr. C. S. Case believes the best results may be attained in the bodily movement of teeth in the cases being considered. With the aid of a fulcrum bar the crowns may not move toward each other any faster than desired, the force required to bring the tooth forward being applied so far root-wise that bodily movement is secured.

Drs. Singleton and Bowman refer to the value of the Lourie "ligature jack"—a more or less familiar device.

A. C. Gifford has referred to his success in tooth movement of the character referred to, thru the use of spring wires, the same being doubtless attached to the lingual arch. He states in this connection, that the anchor teeth may be moved with intermaxillary elastics. This contemplates the movement of the teeth singly. Walter H. Ellis of Buffalo also states that he has been successful with the use of finger springs in connection with the lingual arch, altho he sometimes uses a modification of the "pin and

tube" appliance to move the roots. It would seem that the finger springs might not be depended upon to produce bodily movement of the teeth.

F. C. Kemple, who is one of our good disciples of nature, states that in some of these cases the spaces will close of themselves, without treatment, if given time. When they do not close he advises the bodily movement of the teeth.

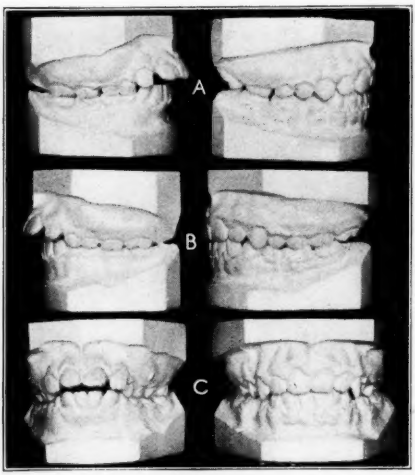

Fig. 5, *a*, *b* and *c*.—Case of Dr. James D. McCoy of Los Angeles. Mandibular second bicuspids congenitally absent; first permanent molars moved mesially as soon as deciduous molars were lost (the roots of the latter were absorbed in the natural way).

I think few of us doubt that the spaces will close in some instances, but some of us are not over-sanguine as to the result. Too often much tipping is in evidence. While we are waiting for the uncertain chances that this movement will be satisfactorily accomplished unaided, we may be sacrificing the opportunity of doing the work at the age of early childhood, a period when our efforts produce desired results with the minimum expenditure of time and labor.

V. H. Jackson states: "I have used a collar with perpendicular or horizontal tube, or both, attached and cemented to the tooth, with suitable springs extending from an anchorage and entering the tubes." He has more recently continued, he says, to use looped or curved finger springs for this purpose, one end of the spring being attached to a movable apparatus, and the other end free for adding force.

Surgical Aids to Tooth Movement

In some cases I have had the oral surgeon bur away small areas of the process in advance of the tooth to be moved. Doubtless many have noted in the case of an extracted first permanent molar the comparative ease with which the second permanent molar may be brought forward into the place of the lost tooth. Thus in the instance of missing bicuspids the bone resistance may be lessened considerably in the manner suggested. This work, for obvious reasons, had better be done by a skilful oral surgeon.

Difficulties of Tooth Movement

Certainly no orthodontist, nor dentist should undertake these compensatory procedures in the belief that they are easy of accomplishment. They are very often most difficult. In some instances, especially if the patient is more than twelve or fourteen years of age, it is doubtless well to weigh the question thoroly before undertaking these extensive tooth movements. However, the circumstances in each case should help to a decision.

Certain of the respondents to the questionnaire have been quite in agreement with Dr. Angle's well-known formula: "The best balance, the best harmony, the best proportions of the mouth in its relations to the other features, require that there shall be the full complement of

teeth, and that each tooth shall be made to occupy its normal position—normal occlusion."

The striving for this ideal has doubtless been of greater value to the orthodontist than any other pronouncement ever made on the subject. But when it comes to the question of missing teeth, their very absence precludes the possibility of the full realization of this ideal relation. The requirements of "axial stress" must be met, we are told, and it is implied that the movement of teeth into the spaces of those congenitally absent or lost frustrates the possibility of normal stress demands. To the degree that the closing of these spaces involves anatomical inharmonies, or the tipping of teeth, to that degree may this objection hold good. While I believe it is possible to so move these teeth that they will not be tipped at all, I will grant that in the average case bodily movement may not be wholly accomplished. Nevertheless when the procedure is a reasonably skilful one, the results are certainly preferable to prosthetic appliances of whatever nature.

The Questionnaire

A brief digest has been prepared from the responses to the questionnaire which I mailed some months ago. While it is published herewith for the readers' interest and benefit, it must be fully appreciated that those who have been good enough to contribute their suggestions have done so in the very full understanding that many of their observations are most general in character and application. Obviously in many instances the procedure to be followed might depend upon the particular case in hand.

As explained in the letters the questionnaire had reference to compensatory treatment for missing teeth—teeth missing from congenital causes or for whatever reason.

The list of questions follows:

What Would Be Your Procedure?

Maxillary Arch—

Second bicuspid missing?
First bicuspid missing?
First and second bicuspids missing?
First permanent molar missing?
If third molar is also missing, would you vary the procedure, and how?
Both lateral incisors missing?

Mandibular Arch—

Second bicuspid missing?
First bicuspid missing?
First and second bicuspid missing?
First permanent molar missing?
If third molar is also missing, would you vary the procedure, and how?
Both lateral incisors missing?
The questions refer to one side of the arch only, excepting the lateral incisors.
If you advocate a prosthetic appliance for supplying missing teeth, what particular method do you favor?
If it is your practice to close up "spaces" of missing teeth, briefly indicate methods employed—especially in cases of stubborn tooth movement.
Have you slides of one particularly interesting case, showing results of treatment?

Many orthodontists in returning the questionnaire omitted to comment on the absence of third molars, and how this might influence their procedure in dealing with missing bicuspids or first molars. Certainly we need to have in mind the fact that the forward movement of molar teeth shortens the arch, and in case the third molar is missing this question gains in importance. I believe the suggestion of J. Lowe Young is a good one, i.e. if the third molar is absent he would close the space of a single bicuspid tooth that might be missing, but in case the first molar is lacking he would favor prosthetic restoration.

I regret that I did not request a report on the percentage of patients in each orthodontist's practice wherein teeth were missing, either from congenital or other causes. In my own practice it is approximately 10 per cent. Some other specialists have given the same percentage.

A number of interesting, indeed val-

uable, letters have been received and very full quotations have been made from them:

FRANK A. GOUGH, BROOKLYN, N. Y.

I have no fixed method of procedure in the case of particular missing teeth.

I consider the problem of missing teeth one of the most difficult that the orthodontist has to contend with. At the present time it is my practice whenever consulted by a new patient to not only make casts from good plaster impressions of both arches, but also photographs and a complete radiographic examination of both maxillary and mandibular arches.

In those cases where permanent tooth germs are found to be missing a very careful study is made of all the conditions present, such as the age of the patient, the inclination of the roots of the teeth present, whether or not there has been a drifting forward of the teeth in the molar region, the type of prosthetic restoration that will be most serviceable in case the spaces are not closed, its effect upon the adjoining teeth, the form of the cusps, the effect on the face, and other like considerations.

In making a rough guess I should say that in not more than 30 per cent of this type of case which I have been called upon to treat have I deemed it advisable to close the spaces, but in those cases where I have followed this treatment I have made it a practice to move the tooth distal to the space bodily forward and I have had some very pleasing results by so doing.

In my hands there is no appliance which begins to compare with Dr. Angle's ribbon arch for either opening or closing spaces, and I invariably use it for this type of work. As a general rule I have found certain adaptations of removable bridge work meet the conditions required for supplying the missing teeth better than anything else.

CALVIN S. CASE, CHICAGO, ILL.

In my practice the whole subject of compensatory treatment for missing teeth depends almost wholly upon the occlusion and dento-facial relations of the case in hand.

In other words, the treatment is largely regulated by the relations which the dentures bear to each other and to the facial outlines. In the case of an *upper protrusion,* for instance, if either one of the bicuspids or the first molars is missing upon one side, I would extract a tooth on the opposite side and close the spaces by retruding the front teeth, for the same reasons that I advocate rational extraction according to my published rules, in the treatment of upper protrusions.

Under the same head if a single buccal tooth is missing in a case of bimaxillary protrusion, I would extract *three* more teeth, and retrude all the front teeth to correct the facial deformity.

In a *partial* upper protrusion with a tooth missing on one side with buccal cusps closing mesial to normal, and on the other side with buccal occlusion normal, I would close the space by retruding the front teeth without extraction.

In cases of normal occlusion with facial outlines *not protruded,* if a tooth or teeth are missing upon one side or both, I would supply the deficient arch or arches with artificial dentures to restore the function of mastication and retain the arches in normal facial relations.

In contemplating the insertion of an artificial restoration tooth or teeth, one should endeavor to place them in an inconspicuous position; in other words, in the buccal region.

Even when one or two upper laterals are missing, I can show numbers of very satisfactory results in which the spaces have been closed by a mesial movement of the cuspids and first bicuspids, followed by grinding off the points of the cuspids and turning them slightly to produce the artistic effect of laterals; and turning the bicuspids to bring the buccal cusps into sharper evidence to produce the effect of cuspids. The main object of this extensive bodily mesial movement is to avoid the unpleasant appearance of the artificial teeth in front of the mouth.

In correcting dento-facial retrusions by extensive bodily labial movements of the front teeth, it frequently arises that spaces are intentionally opened between buccal teeth for artificial *retaining* teeth. I endeavor to have these spaces disposed of by a bodily movement of adjoining teeth to positions which subserve the best purposes of mastication and permanency of the bridge dentures.

In an article that will soon be published in the *Cosmos,* which gives a brief history of a case of this kind, spaces were opened on *each* side of the upper arch which admitted the insertion of a bicuspid and a molar, and with the maintenance of natural upright positions of all the teeth, notwithstanding the fact that the separating movement between the first molars and lateral incisors was seven-eighths of an inch.

J. C. DEAN, OAKLAND, CAL.

I am delighted that you are to discuss this extremely vexing problem in the treatment of our cases. Dentists as a whole do not appreciate the difficulties of *closing these spaces,* as they speak of it. . . . . I feel they are too sanguine of the success of orthodontists in closing the spaces of six-year molars. My experience has been very unsatisfactory in such attempts; and while it has been done in six or seven cases, it has been after exhausting

effort and unusual patience on the part of the particular individual. A word of warning should be sounded by orthodontists so that indiscriminate extractions of these molars would be prevented, and that the watchful care of dentists to prevent decay and the necessity for extraction will be increased.

In my practice now I make the difficulties to be encountered very plain to each patient, and the necessary effort on his part. If he is unwilling, and does not seem over-enthusiastic, I recommend prosthetic work, and especially with children past seventeen years of age.

C. H. JUVET, OTTAWA, CANADA

It is rather difficult for me to indicate any hard and fast rule that I would follow in each case indicated, as there are so many factors to be considered in mapping out just what course to pursue in each case coming under observation.

My practice has always been to open up spaces and replace the teeth lost either by mutilation or congenitally absent, as I have never been convinced of any human results improving on nature, and I have yet to be convinced that as good results can be obtained in an arch with missing teeth as can be obtained in an arch having the full complement, whether natural or artificially replaced of a normal proportion and properly reproduced morsal surfaces. My most pleasing results have always been obtained in those cases where I maintained the normal interproximal spaces between the teeth.

Similarly in prosthetic appliances, circumstances alter cases, but I must say I much prefer a removable prosthetic appliance that does not necessitate the mutilation of the adjoining teeth.

I have closed spaces in the past, but find less difficulty in opening a space than in closing one.

J. A. BURRILL, CHICAGO, ILL.

The more I study the matter the more difficult the questions become, as in no one of the conditions which you mention would the missing tooth be more than a single factor in making a decision as to how to handle it. I can say this, however, that I have probably tried everything that has yet been available, and in no case have the results been perfectly satisfactory. There is one principle which I work on, and keep in mind continually while studying these cases, i.e. if I can save the patient's occlusion and close the space of the missing tooth, thereby eliminating the necessity of an artificial restoration, I think I have done the patient a great service.

I might speak of the missing upper laterals in Class II cases of which I have had a number. I have closed the spaces, carrying the cuspids forward into the positions of the laterals, which positions they tend to occupy under such circumstances. The aesthetic result of such a procedure I think is far beyond and more natural than any artificial substitute that I have ever seen. Here again you must take into consideration the effect of such treatment on the patient's face.

My position therefore, with respect to the questions you have asked would be that no general rule can be laid down for any one of them, each case presenting a problem of its own.

It may be of interest to you, however, to relate that my experience has been that far better results can be obtained in case of one missing bicuspid if the procedure decided upon is to close the space, to sacrifice the corresponding tooth in the same arch, thereby making the movement of the teeth necessarily bilateral instead of unilateral. In my hands a unilateral movement to close the space always tends to sacrifice the desired results in the matter of occlusion.

In the matter of artificial substitutes when inserted it has been my practice to have a fixed appliance in preference to a removable one.

R. C. WILLETT, PEORIA, ILL.

Compensatory treatment for missing teeth has been one of the troublesome problems confronting me ever since I entered the exclusive practice of orthodontia some twelve years ago. The many conditions complicating these cases, as I have found them in my practice, would make it difficult for me to outline a definite procedure of treatment, or to classify them. I would be governed by the age of the patient; the character of the alveolar process; whether or not there was evidence of the patient having been afflicted with an incipient or well-defined case of rickets in early life, resulting in an arrested bone development; and also the relation of the dental arches.

I have found it more satisfactory to increase or reduce space and maintain it where the bicuspid or molar, one or more, have been lost as a result of focal infection than where congenitally absent. The result, in my experience, of opening and maintaining space for congenitally absent lateral incisors has in no case been satisfactory.

The appliance I use in these cases where space is to be made or closed is the same in either opening or closing, except in the direction of turning the double action screw, and the combining or reinforcing anchorage by banding two or more teeth on the end most desirable to remain stationary. The horizontal tubing with threaded bore used on the buccal or lingual, or on both, may be made of sufficient length to assure a bodily movement. I also use the vertical pin and tube appliance,

locking to the anchor band with the loop locking arrangement, as introduced by J. Lowe Young.

As an anchorage for an artificial substitute to fill and maintain the space, I prefer an attachment as advocated and used by J. P. Carmichael, of Milwaukee. When properly constructed, there seems to be in the use of this attachment the minimum danger of gingival irritation or devitalization of the anchor tooth or teeth.

H. L. MOREHOUSE, SPOKANE, WASH.

It is a difficult matter to decide such questions without the individual case before you. I will say that in the most part, I am closing the spaces, especially of missing bicuspids and in some instances where the first molars have been extracted. But I do not think it is good practice to move the molar teeth mesially, unless it is in cases of congenitally missing second bicuspids. In such cases the germ of the first molar has drifted pretty well mesially of itself before time of its eruption.

In the case of missing upper laterals, it depends on the angle at which the cuspids have erupted as to my decision. If the apical end of the cuspid root is about in its normal position, then I do not advise closing the space. If, as in the case of the first molars, the germ has drifted mesially, it is advisable to close the space.

T. M. HAMPTON, HELENA, MONT.

Conditions might vary so much in the cases you present, such as age; shape, quality and size of teeth; size of the mouth; quality of saliva; and general conditions; that it would be almost impossible to answer them without making it very lengthy

In young patients, I would prefer to close the space, if practical. If not practical, I would prefer to make a removable restoration until the patient reaches maturity and mouth conditions become more stabilized and then make the restoration either fixed or removable, as in my judgment at that time would be best.

T. G. DUCKWORTH, SAN ANTONIO, TEX.

Of the conditions we have to deal with, compensatory treatments are the most perplexing. To generalize in response to your questions, I close the spaces created by congenitally absent teeth and open the spaces created by the loss of teeth thru neglect or as a result of focal in ection. This at least is my logic in attempts at treatment.

In both maxillary and mandibular arches I generally open the spaces unless the teeth are congenitally absent and then I close the space, particularly in the maxillary arch. In case of missing first and second bicuspids I have always opened the space in both maxillary and mandibular arches In case of missing first permanent molar I generally close the space unless the third molar is absent. If the third molar is absent I do not bring the second molar forward, but open the space. I have always closed the spaces created by missing maxillary lateral incisors. In case of missing mandibular lateral incisors I am at the present time opening the spaces of an exaggerated Class II, Division I, case with extremely small central incisors and cuspids. The laterals are congenitally absent, but by opening the spaces I can get a development of the mandible, but what to do with the spaces I am unable to say, except by using a small cast clasp bridge to supply the missing members.

JAMES D. MC COY, LOS ANGELES, CAL.

From a theoretical standpoint it would seem the part of wisdom to provide the necessary space for any absent teeth by moving the other teeth into their correct relations and then replace the absent teeth by artificial means. Undoubtedly under some conditions this plan is advisable. A review of the literature of a few years ago will reveal the fact that some of our best thinkers in orthodontia considered this the correct *modus operandi* in all cases and as the result of such teaching the idea was accepted generally. We probably would still be adhering to this principle were it not for the fact that bridge-work in its most perfect form is now regarded as a thing to be utilized when necessary, but by no means a thing to be sought after or planned for, especially in the mouths of young children. There is therefore at the present time a decided tendency on the part of independent thinking orthodontists to break away from this generally accepted and rather dogmatic idea of replacing *all absent teeth by artificial means*, or at least to modify or temper their procedure in such cases.

Therefore whenever it is possible to establish an occlusion reasonably fulfilling the requirements of function (without unduly sacrificing aesthetic consideration) by closing up spaces occasioned by the absence of teeth, thru the movement of such other teeth as may be necessary to compensate for the lost tooth substance, I feel that this plan should be followed.

FRANK A. DELABARRE, BOSTON, MASS.

The questions were gone over very thoroly by the orthodontic staff at the Forsyth, as far as the first permanent molars are concerned, and we came to the following conclusions: Where three first permanent molars were missing or needed to be extracted because of their physical condition, we deemed it wise to extract the remaining first molar, even tho it were sound, for the sake of symmetry.

In regard to all other questions we concluded that there could be no standard of procedure, but that each case must be considered as a separate problem to be decided according to

the varying factors involved. This includes the question as to whether to maintain or to close up "spaces." Where a prosthetic appliance is indicated my preference is for removable partial clasp saddles or plates, instead of bridge-work of any kind.

WALTER H. ELLS, BUFFALO, N. Y.

Question: What would be your procedure, second bicuspid missing, maxillary arch?

Answer: If the anterior portion of the arch was in normal or even fair relation to the lower, and the upper molars had come forward to approximately close the space with fair occlusion, I would not open the space. However, if the diagnosis showed it necessary to move the incisors forward, I might open the space altho would prefer bringing the molar forward if practical.

Question: What would be your procedure, first bicuspid missing, maxillary arch? First and second bicuspid missing, maxillary arch?

Answer: I would open no more space than would seem necessary to establish occlusion, possibly making space for the first bicuspid only.

Question: What would be your procedure, first permanent molar missing, maxillary arch?

Answer: With the first molar missing we would likely find under-development in the incisor region, also enough forward inclination of the second molar to make it advisable to restore the space. However, if the second molar had retained its proper axis, I certainly would not open the space, even tho it were necessary to move the second molar forward.

Question: If the third molar is also missing, would you vary the procedure, and how?

Answer: This might alter treatment by allowing the third molar to erupt forward into the second molar area and eliminate the necessity of considering restoring the first molar space.

Question: What would be your procedure, both lateral incisors missing?

Answer: In the past it has been my practice to make space for the laterals to be filled by artificial substitutes. However, I would now allow the patient's judgment as well as my own to decide our choice for aesthetic reasons. I have opened some lateral spaces where in after years I have wished I had not done so.

In a general way my opinion would be the same in regard to the mandibular arch. However, the solution of the problem would be a bit more difficult than in the maxillary arch on account of its influence on the over-bite. I can recall no such case in my practice.

A. H. KETCHAM, DENVER, COLO.

This is too big a question to answer in anything short of a treatise upon the subject. We have many interesting cases, some under treatment, others finished, in which we have had to decide this question. In some it has been answered by securing normal spaces for the missing lateral incisors and supplying them temporarily upon the retainers until such time as the prosthodontists may do their best. In others we have moved the posterior teeth forward and closed the spaces, with the consequent throwing of the buccal teeth out of normal relations. We have many cases in which the lower second premolar is congenitally absent. In the majority of these we are moving the molar forward, closing the spaces. Then we have some cases in which the first permanent molars, all of them, have either been lost or else badly broken down and the pulps dead. In some of these where the third molars are present we are moving the second molars up against the second bicuspids. In cases where the third molars are absent we again let the prosthodontist do his best in supplying the lost teeth. Where the third molars are absent in cases where the second premolars are also absent, if the temporary molar is present and has fairly decent roots we endeavor to save it rather than to run the risk of shortening the jaws to such an extent that it will show in the features. This is a big question, and will not be decided until many cases have been treated by the different operators, and a careful analysis of the results made. In a year or so I hope to be in a position to give a digest of my cases.

W. O. TALBOT, FORT WORTH, TEX.

About the only cases that I think of where teeth should be moved to close up spaces of missing teeth is where a tooth is missing in the arch and nature has closed the space with the adjacent teeth parallel and some tooth in the opposite arch has been forced out of line to such an extent as to allow a cusp locking to be established that makes it advisable to remove such a tooth. Then the space left from this extraction may be closed by the use of the Angle pin and tube appliance, in which case the tube should be soldered on the bands to be placed on the adjacent teeth so that the tube will be parallel to the long axis of the teeth. The pins should be soldered to a small U- or W-shaped spring platinum gold wire and this appliance sprung into place in such manner as to pull the teeth into place parallel, with the appliance fitted against the bands on the teeth so as to prevent the teeth rotating as they move.

The other occasion for closing such spaces is in the extraction of an upper bicuspid on one or both sides in Class II cases, and in

extraction of a lower bicuspid on one or both sides in Class III cases, in which cases I would use the Angle traction screw with the hook end reinforced with solder and set parallel to the long axis of the cuspid, if it is to be moved bodily in the mouth of a young person. In the mouth of an older person, I prefer to use the Case method, which is to heavily reinforce the bands both on the cuspid or the first bicuspid, as the case may be, as well as on the anchorage teeth with strong arms extending from these bands over the gum surface to a point about two-thirds of the way to the apices of the roots of such teeth, at which point screw pressure is applied to produce the desired movement.

In some cases the cuspid or the first bicuspid can be tipped into position, that is where the apex of the root is already in the desired position. In such cases the hook on the traction screw should be applied to the moving tooth at right angles to its long axis. In producing this movement the only safeguard against dragging or tipping the second bicuspid and the first molar is to band these two teeth to the second molar with stiff band material, unite them with solder, and brace them with a strong wire on the lingual side closely fitted and soldered to the bands. The long tube should be soldered to the bicuspid and the molar band on the buccal side.

The teeth anterior to the cuspid or bicuspid so moved can usually be drawn back and made to follow when the movement is produced on both sides by using a small arch wire with hooks for rubber bands, the ends of such wire resting in small tubes soldered to the traction tube, the rubber ligatures or traction cable can be used from the hooks over the distal end of the tube supporting the arch wire; and when such movement is completed, the same appliance serves as a retainer by substituting heavy ligature wire for the traction cable or rubber ligature, or a separate labial arch wire may be substituted with any of the spring clasp attachments to hold it in place.

JOHN V. MERSHON, PHILADELPHIA, PA.

There is no rule to be followed by which you can prescribe without seeing the patient and knowing all of the surrounding and connecting circumstances. Keeping this in mind and with an attempt to map out a general plan regarding the maxillary arch I would usually close the space for a missing second bicuspid and I would also close the space for a missing first bicuspid. Where the first and second bicuspids are both missing I would not attempt an answer; they have to be dealt with as individual cases.

I would also close the space of a first molar irrespective of a third molar.

I would follow exactly the same procedure in the mandibular arch. With both lateral incisors missing I have on a number of occasions brought the cuspid teeth over next to the centrals and have not regretted it. My patients have regretted it in one or two cases where in my earlier practice I advised supplying the missing teeth with some kind of an artificial substitute. The long experience I had in general practice has lead me to disapprove of artificial substitutes for missing teeth wherever it is possible to avoid them. If it became necessary for me to supply one tooth I would refer the patient to the man in my city best fitted to do that particular line of work and if I had confidence in him I would take his advice.

I could not think of outlining a method for closing spaces, as it is such an individual matter, each case presenting such distinctive problems that it is difficult to generalize. In bringing upper and lower molars forward, by and large, the most satisfactory method that I have employed is to use an outside expansion arch of No. 19 gauge with small tubes on the molar bands so that the arch can slip thru rather easily. I use the rubber elastic to hook over the end of the arch and slip over a little hook which I keep moving into position as the tooth moves forward placing that hook just far enough mesial to the tube so that the pull of the elastic is comparatively slight. As the tooth moves forward I unsolder my hook and move that farther forward, and if one is sufficiently careful about the amount of pressure from the rubber elastic molars can be brought forward without having any effect on the anterior teeth, as a rule.

ROBERT H. W. STRANG, BRIDGEPORT, CONN.

I do not see how one can answer your questionnaire with any degree of intelligence for the very reason that the determination of the best method of treatment in cases complicated by missing teeth is one of the most difficult and perplexing problems in orthodontia, and therefore every such case requires individual study of the most intensive character, with accurate models, photographs, and radiograms at hand.

Speaking very generally, I feel it to be better treatment at the present time to refrain from opening spaces that necessitate artificial substitutes. I also believe that an effort should be made to close any spaces that are present when the corresponding tooth for such a space is missing.

VARNEY E. BARNES, CLEVELAND, OHIO.

The condition of missing teeth is one that makes all such cases peculiar and calls for treatment that will be more or less individual to that case. This condition necessitates X-rays of all the teeth and the study of the case with that record as a guide. *Generally,* our

endeavor is to close spaces to avoid necessity of artificial restoration. The decision to be made in all cases *must be* as regards the lesser evil in this case.

The type of case and mal-position of all teeth and positions of all teeth *inclusive* of *third* molars, must be considered in the final decision. A general statement of what should be done in these cases should almost *never* be made. . . . . Stubborn tooth movement seems to be almost invariable in these cases. Considerable movement beyond the desired place is required to break up old bone formation, and long retention is indicated.

CHARLES R. BAKER, EVANSTON, ILL.

In answering the questions I infer that we are to consider that the occlusion is otherwise practically normal, for there are many cases of malocclusion where we are glad to find that a particular tooth is absent.

I might say that I have had one patient in which the following teeth were congenitally missing: one upper lateral, all upper and lower bicuspids, and all second molars (thirteen teeth missing). In this case, after moving the teeth a considerable distance, I advised bridge-work.

MILO HELLMAN, NEW YORK, N. Y.

Regarding my procedure in the cases as outlined by you, I base the same upon the conditions of the rest of the dentition. These conditions in turn I decide upon by the merits of the dentition judged by its morphologic, physiologic, and anatomic value.

FRANK E. SHELDEN, KANSAS CITY, MO.

There are so many details that enter into each individual case, especially the age of the patient, the condition of the remaining teeth, and also how much of the facial harmony has been destroyed by such loss, and if the loss was by extraction, or congenital. Wherever it is possible I believe that the spaces for bicuspids and molars should be closed, rather than opened and teeth supplied by artificial work. This does not apply, however, to missing lateral incisors, upper or lower, as I believe in no instance could these spaces be closed without disfiguring the patient greatly.

ADELBERT FERNALD, BOSTON, MASS.

As a rule, I try to close up all spaces by bringing the teeth forward, either above or below. In Class III cases I would supply upper missing laterals, preferably on a small plate. I can only answer these questions in a general way: what I would do in one case I might not do in another. In supplying lower teeth I like the lingual bar.

In closing up spaces of missing teeth I make appliances with reinforced anchorage, using jackscrews, intermaxillary elastics, grass line, etc.

LLOYD S. LOURIE, CHICAGO, ILL.

It seems imposible to give definite answers. Like other orthodontists I have come to the conclusion that it is not always wise to open up spaces for missing teeth. On the other hand, I would not always close up spaces to avoid bridge-work. I would insist, however, that the bridge for one or two teeth be fixed with two good, solid attachments. Most of my troubles have come from bridges with only one attachment or from the use of bands or short pins. I prefer two good solid inlays.

As ideal conditions cannot be obtained, I would neither open nor close spaces where teeth are missing unless there is reasonable certainty of decided improvement worth the effort.

WILLIAM H. PEARSON, NORFOLK, VA.

Each individual case differs. I have made it a rule for the past few years to make a compromise and close up all spaces possible in young patients. I believe it is to the best interest of the patient as it is only a question of time, if artificial work is resorted to, when the bridge abutments are lost, causing endless trouble.

GENETTE W. HARBOUR, LOS ANGELES, CAL.

Nature had a definite purpose in planning the mechanism of the dental arches, and I consider it a very serious matter to interfere with her plans. Further, I refer you for my opinion to Dr. Angle's seventh edition, page 63.

WILLIAM E. WILSON, PASADENA, CAL.

I am thoroly convinced that one of the greatest needs in dentistry today, as well as in orthodontia, both for the efficiency of the masticating machine and for the welfare of the tissues adjacent to the roots of the teeth, is that all teeth subjected to stress of mastication should be in such perpendicular axial alignment as to offer the minimum tendency in direction of force either mesially or distally.

In other words, every tooth should be in its anatomically correct position and location as regards the long axis, as well as occlusion.

LAWRENCE W. BAKER, BOSTON, MASS.

Sometimes in these cases I supply, and sometimes I extract—basing my judgment, of course, on existing conditions. . . . . In order to be of some help, I am sending you photographs of a case of a girl thirteen years of age which I think has a direct bearing on your problem, for the lower bicuspid on each side was congenitally missing. In the treatment of this case I compensated by extracting the upper first bicuspids, with the result shown in Group II. I greatly regret that I have no records of the facial lines, but if my memory serves me correctly the facial contour was ex-

cellent after treatment. I thought also you might be interested in a set of rules I have worked out for my students regarding the conservation and extraction of the six-year molars.

Group 1. Before the Eruption of Twelve-Year Molars

Rule 1. When one, two or four six-year molars are broken down and pulps exposed, *before the eruption of the twelve-year molars,* extract the molar or molars in question. In case three six-year molars are so diseased, extract all four molars.

Example 1. When one six-year molar is broken down with exposed pulp (the opposing six-year molar in good condition) *extract diseased molar only.* The erupting twelve-year molar will move forward and fill the space without tipping.

Example 2. When one superior and one inferior six-year molar on same side are broken down and pulps exposed *extract both diseased molars.* The erupting twelve-year molars will move forward and fill the spaces without tipping.

Example 3. When one superior and one inferior six-year molar on opposite sides are broken down with exposed pulps *extract both diseased molars.* The erupting twelve-year molars will move forward and fill the spaces without tipping.

Example 4. When both superior or both inferior six-year molars are broken down with exposed pulps *extract both diseased molars.* The erupting twelve-year molars will move forward and fill the spaces without tipping.

Example 5. When three six-year molars are broken down and pulps exposed *extract all four six-year molars,* tho the fourth molar is in good condition. The erupting twelve-year molars will move forward and fill the spaces without tipping.

Example 6. When all four six-year molars are broken down and pulp exposed *extract all four six-year molars.*

Group 2. After the Eruption of the Twelve Year Molars

Rule 2. When one or more six-year molars are broken down and pulps exposed, after the eruption of the twelve-year molars, save six-year molars if possible; otherwise, extract unsavable molar or molars and supply the full mesio-distal diameters. This procedure will prevent tipping of twelve-year molar or molars.

Note.—The foregoing rule is self-evident; no examples are therefore necessary.

D. O. MARTIN, SALT LAKE CITY, UTAH

When I get a case with a missing lateral or bicuspid I am at a loss to know what to do. My procedure, however, in the majority of cases is to open the spaces and refer the patient to his dentist for an artificial substitute, in patients whose teeth are fully developed. In younger patients I frequently close the space.

In closing spaces where bicuspids are missing a favorable place is left for a pyorrhea pocket in later life, because the teeth do not stand straight; I mean the teeth are left in such a position that the stress of mastication is not in a straight line with the long axes of the teeth, resulting in lateral stress.

I have two cases in mind now, one a boy ten years of age, with both superior laterals missing. I am not doing anything with it now. The other case is a little girl nine years old with both laterals missing.

These conditions present a real problem.

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Discussion

J. C. Dean, Oakland, California: I know the work that Dr. Gray has put upon this paper and I appreciate his effort to give us some solution of the treatment to be followed in cases of missing teeth. I feel that the aver-

	MAXILLARY ARCH				
	Second Bicuspid	First Bicuspid	First and Second Bicuspids	First Permanent Molar	If third M ing Would Foregoing
Frederick C. Kemple, New York	Allow first molar to come forward	Allow first molar to come forward	Artificial appliance (1)	Close with second molar (2)	No
Wilson W. Foster, Cincinnati	Open space	Open space	Open space	Open space	No
W. J. Lea, Vancouver, B. C.	Usually replace (1)	Replace (2)		Rarely replace, move second molar forward	Replace b molar, co favoring
A. L. Hipwell, Paris, France	Close space	Close space	Removable bridge	Fixed bridge	
D. O. Martin, Salt Lake City	Usually open (1) space	Usually open (1) space			
W. J. Brady, Kansas City, Mo.	Supply	Supply	Supply	Supply	No
Herbert A. Pullen, Buffalo	Close if possible	Close if possible	Bridge	Move second molar into space	If lower in occlusi treat
John V. Mershon, Philadelphia	Usually close	Usually close		Close space irrespective of third molar	
Julius Minez, Newark, N. J.	Close if possible	Close if possible		Attempt closing	
C. H. Juvet, Ottawa, Canada	Open and supply	Open and supply	Artificial appliance	Open and supply	
Burt Abell, Toledo	Move first molar forward	Move teeth forward	Artificial appliance		No
Harry E. Kelsey, Baltimore	Usually close	Usually close	Make restoration	Usually endeavor to close	Restore b molar
Genette W. Harbour, Los Angeles	Preserve space	Preserve space	Restoration	Preserve space	
Varney E. Barnes, Cleveland	Usually endeavor to close	Usually endeavor to close	Usually endeavor to close	Usually endeavor to close	
William Cavanagh, Portland, Ore.			Artificial appliance	Close space	Probably
Adelbert Fernald, Boston	Usually close	Usually close		Usually close	
Robert H. W. Strang, Bridgeport, Conn.	Close if possible	Close if possible		Endeavor to close	
James D. McCoy, Los Angeles	Close space	Close space	(1)	Move second molar mesially	No
Guy G. Hume, Toronto	Close	Close		Close, moving molars mesially	Supply molar
J. B. Morrison, Montreal	Close	Close	Artificial appliance	Close, moving molars mesially	No
O. A. Oliver, Nashville	Close	Sometimes close	Removable bridge-work	Close if possible	No
William C. Fisher, New York	Close if possible	Close if possible		Usually try to close	
William H. Pearson, Norfolk, Va.	Close (1)	Close (1)	Preserve space	Close (1)	No
A. C. Gifford, Oshkosh	Close (1)	Close	Preserve space	Close (2)	If space finish m otherwis
C. C. Howard, Atlanta	Close	Close	(1)	Close	No

DIGEST OF QUESTIONNAIRE

		MANDIBULAR ARCH			
Molar Miss- ld You Vary g Procedure?	Both Lateral Incisors	Second Bicuspid	First Bicuspid	First and Second Bicuspids	First Permanent Molar
	Close with cuspids	Close space (3)	Close or allow to close	Allow space to close after absorption of second deciduous molar	Close space
	Depends on case		Same as in maxillary arch		
bicuspids or onditions	Never replace (3)	Replace	(4)	No experience	Replace only when forced to
	Fixed bridge	Close space	Close space	Removable bridge	Fixed bridge
	Usually open spaces	Usually open spaces (1)	Usually open spaces (1)		
	Supply	Supply	Supply	Supply	Supply
third molar sion do not	Sometimes open space	Close if possible	Close if possible	Bridge space	Move second molar into space
	Move cuspids up to centrals	Usually close space	Usually close space		Close space irrespective of third molar
	Removable appliance	Attempt closing	Attempt closing		Attempt closing space
	Supply	Open and supply	Open and supply	Prosthetic work	Open and supply
	Substitute with aid of Carmichael attachment	Usually substitute	Usually substitute	Usually substitute	Usually substitute
bicuspids or	Close, carrying distal teeth forward		Same as maxillary for	Class I or Class III, in Class II would prob	
	Preserve space	Preserve space	Preserve space	Restoration	Preserve space
	Usually endeavor to close	Usually endeavor to close	Usually endeavor to close	Usually endeavor to close	Usually endeavor to close
not	Probably restore space			Artificial restoration	Close if lost prior to eruption of second molar
	Close space, open in Class III	Usually close	Usually close		Usually close
		Endeavor to close	Endeavor to close		Endeavor to close
	Close, moving teeth mesially			Same as in maxillary ar	
bicuspids or	Close, moving other teeth forward (1)	Close, moving molars mesially	Close, moving teeth mesially		Close, moving molars mesially
	Replace artificially in (1) large mouths		Same as in maxillary arch		
	Depends on facial outline	Close space	Usually close	Removable bridge-work	Usually close
		Usually try to close	Usually try to close		Usually try to close
	Close if posible (2)		Same as in maxillary arch		
partly closed, vement, supply	Close (3)		Same as in maxillary arch		
	Close (2)		Same as in maxillary arch		

ARCH			
First manent Molar	If third Molar missing Would You Vary Foregoing Procedure?	Both Lateral Incisors	COMMENTS
space	No	Close space	1. Retain deciduous molars long as possible 2. If lost early 3. Allow second deciduous molar to remain, or close space
	No	Same as in maxillary arch	
e only when to	No		1. Except first molar has moved forward and articulation fairly good 2. Except in mesial occlusion at advanced age 3. All cases have been accompanied by mesial occlusion 4. Usually associated with mesial occlusion and not replaced
bridge		Fixed bridge	
		Usually open spaces	1. In younger patients frequently close space
	No	Supply	Use removable plate or bridge to supply missing teeth
second molar pace	Do not treat	Harmonize with upper arch, if necessary by extraction	
space irrespec- third molar			For additional comments see Dr. Mershon's letter quoted elsewhere in this report
t closing		Removable appliance	Each case a law unto itself and to be considered from individual standpoint
nd supply		Supply	See Dr. Juvet's letter
y substitute		Usually substitute	
II would probably make restorations			As a rule close spaces when it can be successfully done, avoiding artificial restorations. In some cases maintain spaces for developmental purposes, restorations following
e space		Preserve space	
endeavor to		Open space unless case one of excess in mandibular arch	For further comments see body of report
f lost prior to n of second	If second molar tipped, open space and supply first molar	(1)	1. If absent in lower arch only and bicuspid and molar occlusion good, close space. If occlusion of buccal teeth affected would restore
close			
or to close			
llary arch			1 Move molar mesially to compensate loss of one bicuspid and replace other bicuspid artificially
moving molars y	Supply bicuspids or molar	Close, moving cuspids and buccal teeth mesially	1 Reshape cuspids to resemble lateral incisors
	No	Would be inclined to replace them	1 In small mouths contract upper arch and place lower teeth in disto-occlusion
close	No	Depends on facial outline whether to close or substitute	
try to close			
	No	Close if possible	1 Close in young patients 2 Reshape cuspids by grinding—preserve space for adults
	Depends on individual case	Close	1 If conditions favor 2 Other molars being good 3 If of suitable age
	No	Close	1 Would think a long time before supplying artificial teeth 2 Trim points of cuspids, do not use porcelain jacket crowns

	MAXILLARY ARCH				
E. A. Bogue, New York	Preserve space	Preserve space	Preserve space	Preserve space	
William E. Wilson, Pasadena	Preserve space	Preserve space	Preserve space	Preserve space	
Milton T. Watson, Detroit	Close if possible	Close if possible	Preserve space	Close, conditions permitting	
Frank E. Shelden, Kansas City, Mo.	Close if possible	Close if possible		Close if possible	
H. M. Clapp, Utica, N. Y.	Close space	Preserve space	Artificial substitute	Close	Supp
W. C. Smith, Pasadena	Artificial appliance	Artificial appliance	Artificial appliance	Artificial appliance	
C. A. Hawley, Washington, D. C.	Close if possible	Close	Artificial substitute	Close space	No
W. M. Martin, Iowa City, Ia.	Close in some cases	Close in some cases	Artificial appliance	Close space	Supp
G. M. Stallard, San Diego	Restore space	Restore space	Restore space	Restore space	
J. Camp Dean, Oakland	Close if third molar present	Bridge after seventeenth year	Artificial appliance	Close	No
A. E. Scott, San Francisco	Close if possible	Close if possible	Artificial appliance	Close (1)	Supp first
G. F. Bowman, Pittsburgh	Close	Close	Supply	Close	No
John R. McCoy, Los Angeles	Close	Close (1)	Bridge-work	Close	Supp first
L. G. Singleton, Pittsburgh	Preserve space (1)	Preserve space (1)	Preserve space	Close	Supp first
F. C. Wilson, Savannah, Ga.	Preserve space	Preserve space	Preserve space	Preserve space	No
T. G. Duckworth, San Antonio	Usually open (1)	Usually open (1)	Always open	Close unless third molar missing	Open
Allan A. Suggett, San Francisco	Close before twelfth year	Close before twelfth year	Preserve space	Close if lost before eruption second permanent molar	Hold work
C. R. Baker, Evanston, Ill.	Close (2)	Close (2)	Artificial appliance	Close space (2)	
W. B. Power, Seattle	Close	Close		Close	
Alfred C. Rogers, Boston	Close	Close	Bridge-work	Close space	Extr mola
B. Frank Gray, San Francisco	Close	Close	Usually bridge-work	Close with second molar unless third molar absent	Close missi woul first
Victor H. Jackson, New York	Generally preserve space	Preserve space and substitute	Generally preserve space	Increase space to normal and substitute	Subs on a
W. M. Scott, Jersey City	Supply	Supply	Supply	Supply	
H. F. Sturdevant, Portland, Ore.	Close if possible	Always close in class II, and in all cases if possible	Maintain position anterior teeth; allow third molars force molars forward, otherwise bridge	Same as for bicuspids	
O. W. White, Detroit	Replace in 75 per cent of cases	Replace in 75 per cent of cases	Usually replace	Seldom replace if ever	No
G. W. Grieve, Toronto, Canada	Usually close bringing molars forward	Close space	Open space	Close as a rule, if first molar opposite side unhealthy remove and close	
F. Zeliska, Vienna, Austria	Supply with bridge-work	Supply with bridge-work	Supply with bridge-work	Supply	Supp
J. Lowe Young, New York	Usually close space	Usually close space	Substitute	Close provided third molar is developing	If o ing, ply f

NOTE.—In many cases the contributors to this questionnaire have stated that the procedure indicated might not alw

			MANDIBULAR AR			
e		Preserve space	Same as in maxillary arch			
e		Preserve space	Same as in maxillary arch			
ons		(1)	Same as in maxillary arch			
ible		Preserve space	Same as in maxillary arch			
	Supply first molar	Artificial substitute	(1)	(1)	(1)	(1)
liance		Artificial appliance	Same as in maxillary arch			
	No	Close if possible, moving molars forward in some cases	Same as in maxillary arch			
	Supply first molar	Preserve space in some cases; sometimes close	Close	Artificial substitutes	Artificial substitutes	Close
		Restore space	Restore space	Restore space	Restore space	Restore sp
	No		Close	Artificial substitute (1)	Artificial substitute	Close spac favorable
	Supply bicuspid or first molar	Close unless teeth lost after twelfth year	Same as in maxillary arch			
	No	Close	Close	Close	Supply	Close
	Supply bicuspid or first molar	Close (2)	Close	Close (3)	Bridge-work	Close
	Supply bicuspid or first molar	Regain and preserve space	Regain and preserve space	Regain and preserve space	Regain and preserve space	Close
e	No	Preserve space	Same as in maxillary arch			
third	Open space	Generally close space (1)	Open space unless congenitally absent	Open space unless congenitally absent	Always open space	Close spac third mola
before nd per-	Hold space for bridge-work	Close space unless teeth lost after twelfth year	Same as in maxillary arch			
(2)		(1)	Close (2)	Close (2)	Prosthetic substitute	Close (2)
		(1)	Close	Close		Close
	Extract lower third molar same side	Close space except in rare instances	Nesbett removable plate	Nesbett removable plate	Nesbett removable plate	Close spac ond molar dom tooth
cond third	Close space for one missing bicuspid would supply missing first molar	Close, moving cuspid and buccal teeth forward	Close space	Close space	Usually bridge-work	Close, mov molar forv
e to nor- titute	Substitute third molar on appliance	Preserve space and substitute	Preserve space and substitute	Preserve space and substitute	Preserve space and substitute	Preserve s substitute
		Supply	Supply	Supply	Supply	Supply
icuspids		Avoid bridge-work if possible	Try to close	Try to close	Supply	Supply ar
e if ever	No	Depends on merits of case	Replacement best in mandibular arch because of lack of d			
ule, if pposite y re- se		Usually close	Usually close	Usually close	Open space for both unless 1 in upper missing	Usually cl molar opp unhealthy close
	Supply	Supply	Supply with bridge-work	Supply with bridge-work	Supply	Supply wi work
d third loping	If one bicuspid missing, close; would supply first molar	Close, moving teeth forward on both sides	Practically same as maxillary arch			

ight not always apply, the treatment depending on requirements of the particular case in hand. Numerals refer to remarks under

NDIBULAR ARCH				
y arch			Preserve space	All movements are "stubborn" unless made in early youth. Do not close spaces unless you need discipline
y arch			Preserve space	Never close spaces. Where spaces have been closed radiograph the long axes and note axial stress
y arch			Never have closed such spaces	1 Close sometimes if nasal development is good, otherwise not
y arch			Preserve space	
	(1)	Supply first molar	(1)	1 Favor artificial substitutes in the mandibular arch, except where one incisor only is missing
y arch			Supply	
y arch		No	Close if possible	In general I close spaces wherever I can
stitutes	Close	Supply first molar	Artificial substitute	
	Restore space		Restore spaces	Removable bridge-work
stitute	Close space (2) under favorable conditions	No		1 No success moving second bicuspid forward 2 Under favorable conditions and patient under seventeen years of age
arch		Supply bicuspid or first molar	Close unless teeth lost after twelfth year	1 Age being suitable move second molar forward if first molar is lost before second erupts
	Close	No	Close	
	Close	Supply bicuspid or first molar	Classes I and II bridge-work—Class III close—maintain arch relations	1 In Class II substitute cuspid 2 Place lower arch in distal occlusion 3 In Class III substitute cuspid
reserve	Close	Supply bicuspid or first molar	Preserve space	1 If molars in mesial occlusion and anterior requirements good, allow space to close
arch		No	Preserve space	Support bridge-work by "Hoods," properly made
pace	Close space unless third molar absent	Open space	Open spaces	1 Unless congenitally absent
arch		Hold space for bridge-work	Close unless teeth lost after twelfth year	
titute	Close (2)	Depending on number of teeth in upper arch, etc.	Prosthetic substitute	1 Prefer small spaces or slightly narrowed arch to prosthetic substitute 2 Would "attempt" to move posterior teeth mesially
	Close		(1)	1 Restore by aid of Carmichael attachments on cuspids
ble	Close space with second molar and wisdom tooth (1)	Depends on case	Possibly supply, leaving spaces in some cases	1 Extract upper wisdom tooth
work	Close, moving second molar forward	Close space for missing bicuspid. Would supply missing first molar	(1)	1 Occlusion of buccal teeth being good, would use artificial substitutes; otherwise would close spaces, moving cuspids and buccal teeth forward. See further comments elsewhere in this report
nd	Preserve space and substitute	Substitute third molar on appliance	Preserve normal spaces and substitute	
	Supply		Supply	Removable work; Supplee split tube abutments preferred
	Supply artificially		Avoid bridge-work when possible	
use of lack of development				
oth er	Usually close—if first molar opposite side unhealthy remove and close		Close space	If third molars missing, as a rule would open space
	Supply with bridge-work		Supply with bridge-work	
		If one bicuspid missing, close; would supply first molar	Same as in maxillary arch	Pin and tube appliance often used

remarks under heading of "Comments."

age orthodontist has not planned the work at the outset of the case, rather preferring to work along observing progress to a satisfactory or unsatisfactory conclusion. A definite outline of the treatment should be made at the beginning, and a definite plan followed out. In this way we can report cases in the future so that Dr. Gray may have the experience of more men thruout the country which will be to the advantage of us all.

B. G. DeVries, Minneapolis, Minnesota: It seemed to me that the lack of one or more teeth in dictating the treatment was only a fractional part of the things to be considered. There are many thing we should consider—the facial development of the patient, probably most of all the age of the patient, and also the tooth size in relation to the size of the head. Again, I have found that the mesial or distal relation of the arch is a vital factor. Sometimes we conclude where the laterals are missing that we should close the space. In other cases I have opened the space—it is difficult to say which to do. If we have congenitally missing teeth, the premise to be made is that the jaw is underdeveloped because of the mere absence of the teeth. I have in mind the case of a girl of about eighteen who lacked nineteen of her permanent teeth. Again, we meet cases with three or four or even six teeth missing. In these cases it is a foregone conclusion that the arch will be undeveloped and we have to open up these spaces in order to correct the balance of the face.

Dr. Gray mentioned the migration of teeth to overcome these defects. I was convinced of the practicability of this in a man of thirty-eight. He had lost both of his upper bicuspids and the six-year molar had migrated and filled up the space. The second and third molar had followed it and you would be surprised at the occlusal surface. Had he had a bridge put in he might have lost two or three teeth by the time he was forty.

The great beauty of Dr. Gray's paper is that it brings home the absolute necessity of putting yourself in place of the patient on whom you are working. We cannot say dictatorially that this or that must be done. I think the subject is a very delicate one and our own grasp of the subject must control us in our course of action.

Dr. Gray (closing): I think Dr. Dean's idea of outlining the treatment at the very start is very good. Too many orthodontists I believe fail to realize how much depends on proper diagnosis and a carefully planned method of treatment. However, we cannot always foresee every step that may be required in a given case. A certain procedure may be more successful in one instance than in another.

Many in sending in answers made it clear that they did not wish their statements to apply in every case. The matter of the absent teeth being only a fractional part of the problem is a very good point. However, in point of time and effort required in many cases, it forms a very outstanding part of the treatment.

As to the influence of mesial or distal relations of the arches on treatment of these cases, I want to refer you to the table accompanying this paper. John R. McCoy of Los Angeles made the most definite suggestions along this immediate line.

SURGICAL PREPARATION OF THE ORAL TISSUES TO ELIMINATE INFECTION AND IMPROVE THE AESTHETIC AND STABILIZATION VALUES OF THE ALVEOLAR RIDGES FOR CONSTRUCTION OF PROSTHETIC RESTORATIONS

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PERFECT oral prophylaxis from the cradle to the grave, in order to establish immunity to the evils which at present are responsible for the conditions which make dental surgeons and dental restorations necessary, is but an idle dream of the impractical idealist.

Whether the necessity for dental restorations is the result of ignorance or neglect, upon this generation rests the responsibility of meeting the conditions as they exist, if we expect to improve mouth conditions and give or sell dental service commensurate with our noble profession.

It has been said there is no other profession which demands of its followers greater variety in the matter of intellectual attainments and physical accomplishments; and dentists in their highest development must combine within themselves some of the special and peculiar mental and practical qualities and qualifications that belong to the surgeon, the engineer, the artist and the artificer.

We will give the surgeon first place in our consideration because he prepares a place for our dental restorations and also because his efforts have a larger and more direct influence upon systemic conditions, and the systemic welfare must always outweigh in importance any purely local considerations.

It should be the moral obligation of every surgeon to conserve vital and normal tissue to the greatest possible degree and to interfere with normal function in the least possible degree. He should use his efforts and ability to relieve or to mitigate pathological and abnormal conditions.

Upon the dental surgeon falls the responsibility of the welfare of all teeth present and of the tissues in the field of operation and those relating to it and indeed the whole organism so far as it may be influenced by the status of these parts from the physiopathological point of view. His purpose should be to place the mouth as nearly as possible in a physiological condition.

The surgeon's first duty should be to investigate or survey the field of operation and its environment by every means possible at his command. He should know as far as possible the condition of each tooth and of each of its retentive and surrounding tissues. Especially should he carefully note all of these characteristics for teeth or roots of teeth that are to be left and used for partial denture retainers.

He should include in his oral examination caries, erosion, fracture fistulas, occlusion, defective fillings, or other defects. He should be absolutely certain regarding the condition of pulps in any teeth whether pulp is vital or non-vital.

He should note the presence of deposits or other accumulations on the

teeth, of artificial crowns or bridge abutments, of protruding, overhanging margins of fillings injuring or menacing the vascular tissues, of spaces between teeth which admit the crowding of fibrous particles of food into the tissues, of fistulas or other evidence of deep-seated morbid conditions. He should explore all pyorrhea pockets and note the amount of osseous support lost thru its destructive processes. He should have a complete dental radiographic examination of the patient to aid an accurate diagnosis. He should note all hard and soft areas, the ending of the hard palate and the beginning of the soft; the size and shape as well as the relation of the maxillary arch to the mandibular, and all muscle attachments that may interfere with or help dislodge a denture.

He should pay attention to the attachment of the frenum labia, the size and shape of the mouth and throat; any inflammatory areas or sinuses; the tongue, the floor of the mouth and cheeks; the physical size and form of the mandible and maxilla, the condition of the soft tissues, the height of the border tissue and muscular attachments, as well as the saliva conditions.

To complete the diagnosis before operating any case, occluded study models are indispensable, as they afford lingual as well as buccal and labial views and give the operator a better conception of the procedure indicated, where the preparation is to be made for full dentures. In the more difficult cases, where at first glance it appears that the removal of considerable alveolar process is necessary, it is advisable to make a second set of study models and carve to represent the arches following the extraction of the teeth. This procedure is followed in order to avoid trimming in excess, a mistake that is very easy to make and one that is irremediable. It is also a great help to the prosthodontist from an aesthetic standpoint, to have a compound impression in which the natural teeth can be placed after extraction, showing their natural arrangement. Such models are of assistance to the dentist in the reproduction of the original set-up in those cases where indicated. However, in many cases we know nature can be improved upon by changing the natural teeth arrangement or typal form; and by comparing these models with the reproductions, all of the destructive arguments sometimes presented by relatives and friends of the patient, that the dentures are not correct, can be refuted. Then, too, for business or social reasons, our patient cannot afford to be without teeth, and if new dentures are to be placed in the mouth immediately following extraction, the study models are of great assistance in constructing them. Of course it is expected when dentures are immediately placed after trimming the process, that it will be necessary to rebase them in a few weeks.

The study models furnish us with an opportunity of classifying the mental attitude of the patient, as they are a great help in demonstrating to the patient abnormal conditions as compared with normal. They also demonstrate the natural typal form of the alveolar ridges which indicates a difference in the surgical treatment, as will be shown later. This procedure helps to establish the confidence of the patient in the operator and is especially helpful in abnormal cases, as the time has passed when the dentists can afford to sacrifice efficiency in dentures, as well as personal appearance of the patient thru ignorance. Some one will inform the patient that an injustice has been done him as the unsightly conditions might have been greatly improved, instead of being made more conspicuous. The study models have the added advantage, in that they can be utilized for the purpose of making individual trays that will require the minimum amount of material to make a correctable impression.

If any degree of success is to be hoped for in the art of artificial denture construction, it is imperative that we have

a good foundation upon which to begin construction. When we consider how small the degree of efficiency of artificial dentures is, compared with the natural masticatory apparatus and when we think of the difficulties encountered to obtain this small result, even under normal circumstances, we realize that the importance of surgical interference to correct any abnormality of the maxillae cannot be too greatly emphasized. The dentist no longer finds it necessary to consider these irregularities of the alveolar ridge, permanent or irremovable barriers around which he must construct his dentures, but much to the contrary—he plans the surgical shaping of the arches as the builder clears ground for the construction of his foundation.

Just in recent years has this branch of surgery gained prominence. A simple technic has been worked out with such success from both aesthetic and efficiency standpoints that it is fast becoming the routine practice of the average prosthodontist.

It is the purpose of this paper to give the various steps in the operation, paying special attention to the curettage of septic sockets and enumeration of some of the dangers encountered in this work.

The patient is prepared as in the case of any major operation and all rules of asepsis strictly adhered to during the operation. Conductive or general anesthesia under nitrous-oxide-oxygen is used. We prefer general anesthesia.

Before the extraction of any of the teeth, the buccal and labial flaps of soft tissue are prepared. A very even flap is had by making an incision starting at the posterior tooth and continuing across the ridge in as nearly a straight line as possible, meeting the highest point on the face of the crown of each tooth, excluding the gum festoons from the flap. In spaces where teeth have been previously extracted, the incision is carried across the ridge to the next tooth. This affords the longest possible flap (which is usually needed) and if it comes at all close to the lingual ridge of soft tissue, a very neat result is realized, with quick healing and very little discomfort to the patient. By means of the periosteal elevators, the muco-periosteum is retracted, exposing the whole of the alveolar ridge. The teeth are then extracted with the least destruction of the buccal and labial plate of the alveolar ridge. Without mutilation of the ridge there is less shock to the patient, the arch is easier to shape, whereby the possibilities of ideal results and more rapid healing are increased. The method of procedure for the removal of the teeth will of course depend upon the case.

The mouth now presents a mutilated and ugly appearance with the gum festoons still attached to the interproximal osseous septae. These festoons are dissected loose from those bony septae back to the lingual ridge and by means of surgical shears, following close to the lingual ridge of the arch, are excised as closely as possible, allowing no lingual ridge of soft tissue to remain. The pointed spiculae of bone between the root sockets and the sharp alveolar prominences are easily removed with Rongeur forceps preparatory to the final shaping of the ridge. In determining the extent to which the process should be trimmed, the operator is guided by his previous study of the models of the patient's mouth, the observance of malocclusion or relation of the maxillary arch to the mandibular arch, the amount of gum that shows in the act of smiling or talking, but mostly by his previous experience in this branch of oral surgery, and his knowledge of denture construction. Even after a careful study of the case, very often the operator is face to face with a lack of sufficient, instead of too much, bone and is forced to change his plans during the operation. The frequent occurrence of this predicament cannot be too strongly emphasized as the greatest danger in this work.

The alveolar ridge has now taken on a more or less definite shape, but requires

the smoothing of the sharp edges, proper beveling for ridge lap and base plate and the general shaping of the arches.

At this time we should refer to the study models, bearing in mind the typal form of the arch we are operating upon and remembering the following facts regarding physical size: (1) large upper or lower affords the greatest possible advantages for stabilizing the dentures; (2) medium size affords less advantage for stabilizing the denture; (3) small size presents much difficulty in stabilizing dentures, consequently much less efficiency in service.

As a general principle, the alveolar ridges should be leveled on their bearing surface as much as possible, simply rounding lingual margin to remove sharp ridges. The buccal margin should be beveled to accommodate ridge lap of the teeth and eliminate abnormal irregularities.

In Class 1, or the square type, we usually find the ridges very strong in their cuspid or bicuspid regions, and it is necessary to bevel the buccal margins higher at these points than any other typal forms.

In Class 2, or the tapering type, we find it necessary to make the long bevel on the labial ridge, near the median line and also to eliminate much soft tissue from the bearing surface of the tuberosities in order to get a level bearing and greater stabilizing value for dentures. It is in this typal form that we usually find a narrower throat and a greater amount of soft tissue around and between the tuberosities, or in other words more displaceable tissue.

In Class 3, the ovoid type, the long bevel is also usually necessary in the labial ridge near the median line.

Both sides of the arch should be made as symmetrical as possible in order that the artificial teeth may be placed on the ridge in their proper positions.

Smoothing of all margins is accomplished by thick heatless stone, which is drawn up and down over the sharp edges and produces a very smooth result. The stones are preferred to files or curettes as they are easier to manipulate and there is less danger of laceration of soft tissues, which means less discomfort to the patient and a rapidly healing wound.

All previous consideration and steps in the operation, whether they be for aesthetic or mechanical reasons, are of only secondary importance to the removal of the pathological areas connected with the teeth. This part of the operation is of paramount importance and is one upon which not only the success of the operation rests, but the health and perhaps the life of the patient. It surely commends our most careful and most thoro consideration, as to the method of procedure to adopt in the elimination of these areas and all disorganized tissues.

It has always been an acknowledged fact among oral surgeons that a thoro curettement of any infected areas associated with the teeth is necessary to a successful operation, but only in recent years, in fact the last three or four, has this procedure been accepted by the profession in general. The more universal curettement that is being carried out by the dentists today is perhaps the sequel of the established fact that these areas are or may be foci of infection contributing to, if not the sole cause of, the patient's systemic disturbances. Then too with the rapid advance in the art of roentgenology and its universal use, it has been revealed to the more observing men that without a careful curettage frequently the socket of an extracted tooth has healed, again walling in the infection with a more pronounced recurrence of the patient's systemic affection. Having heard so much about oral focal infection and the many ailments attributed to its presence in the human body, the dentist in his zeal to clear the mouth from any suspicion, has resorted to curettement from its mildest form to the removal of the external walls of all septic sockets to

the very root ends, commonly called external alveolectomy.

The question naturally arises, Is curettement of the sockets of all non-vital teeth indicated, and, if not, when, where and to what degree? We know that the danger of an infected socket is not determined by the size of the granuloma but by the virulency of the organisms present, the resistance of the patient, and the tension under which these organisms are working; it therefore seems only logical to assume that a certain amount of curettement is warranted in each case, or at least an exploration of the socket. We must also remember that often roentgenograms fail to show any active periapical trouble, in some cases, but upon operating the opposite condition is revealed; and we find considerable destruction of the surrounding osseous tissues.

The degree of curettement warranted in each infected socket will depend upon the amount of the involvement of the tissues, the location of the abscess, the resistance of the patient, and the virulency of the bacteria present. The latter can only be definitely determined by making a culture, but if the destructive process is rapid, we can feel sure that the organisms present are very virulent and a radical operation is indicated. In such event it seems but wise to perform a radical curettage to remove not only the involved tissues but the apparently healthy underlying structures in order to reduce the amount of diseased tissue and approach as nearly as possible the healthy structures.

If the patient is in a weakened condition it would only be fair to him to perform a thoro curettage of all sockets that retained non-vital teeth, resorting to the external alveolectomy in cases where the outer layer of cortical bone is involved close to the gingival, or any other case where necessary in order to establish proper drainage. However, in some of these cases of very low resistance, removal of too much tissue may tax the reparative powers of the patient more than if nature is left to care for the small amount of infection that may have been missed otherwise, and in such case the patient will have to rely on the surgeon's good judgment.

At the time of the preliminary examination of the patient, careful thought and consideration should also be given to the removal of all pathology involving the oral tissues. With a set of good detailed roentgenograms of the affected parts and a careful examination of the mouth, the operator can determine in a large percentage of cases the extent of pathology and the conditions he may expect to find on operating. However, we must remember that the roentgenograms are not infallible and the findings corroborated in each case by a careful exploration of the sockets after the extraction of a tooth should govern the method of procedure. Let the sense of touch, such as relied on in prophylactic technic in the mouth, and a very small curette be the guide. We must not forget to carefully inspect each tooth when extracted, for often the granuloma is removed with it and curettement is then unnecessary. The curettage should be done immediately following the extraction of each non-vital tooth. The roentgenograms should be held to the light by an assistant or placed upon a mount so that the operator can see them during the operation. Curettement of each tooth socket should always be started with a very small curette, one that is capable of reaching the very apex of the socket. In the small abscesses this size of instrument will suffice, but, if not, a larger one can be used. The mistake is very often made of using a curette that is too large, and the seat of infection is not reached.

In cases where roentgenograms show only a small rarefied area at the apex, and upon the removal of the tooth, the end of the root is denuded, we can expect to find, upon exploration, a small granuloma. Upon exploring with a small curette, no larger than the width of the

apex of the tooth root, a small cushion-like object is found, which can be easily removed by gentle scraping and teasing down the socket. Whenever this cystic membrane of any size is found at the root end, it is only necessary to remove this soft tissue and not curette the osseous tissues beyond. If necrosis has occurred, curettement of the bony walls is indicated with paralleling of the walls to establish drainage in cases where the destruction of tissue is greater than the diameter of the tooth socket.

If the outer layer of cortical bone is involved, this will be exposed in the retraction of the muco-periosteal flap or by exploration, and will also be a guide in deciding the degree of curettement necessary. In such cases it is advisable to remove the outer wall of the socket providing the gingival third of the plate is involved, but only in such cases does such a radical operation seem warranted. If the gingival third of the alveolar plate is not involved, it is advisable to remove only the portion at the apical third of that tissue which appears involved, allowing the gingival margin, which is in good shape, to remain. In this way the contour of the arch is retained by this bridge of bone and a good foundation is left, over which there will be regeneration of the lost tissue. Nevertheless the fact that some operators advocate the removal of the outer alveolar plate, together with the radical removal of considerable of the circumference of the involved area, with the belief that they are eliminating all infection is very illogical; but it has been proved in a number of research laboratories that the bacteria have penetrated as far as one-quarter of an inch into what appears and is thought to be normal osseous tissue. To date there is not enough convincing evidence to deem it necessary to remove the entire buccal or labial plate of the alveolar ridge to the apex of each and every infected root socket in order that all pathological areas may be eliminated.

In third degree pyorrhetic cases it is essential to remove the unorganized membrane lining the pyorrhea pockets. This can easily be done by loosening it with a curette and when partially detached from the bony wall by holding with hemostatic forceps and dissecting from the bone and gum festoons. This tissue must be removed if we are to avoid a suppurating socket filled with unorganized tissue that will necessitate a second curettement. Due to the hemorrhage that is always met with in removing this membrane, it is difficult to differentiate between it and the swollen inflamed gum festoons, but when it is all removed the bleeding subsides.

The instrumentation necessary to a thoro curettage of infected sockets and associated areas is a set of straight and right and left spoon curettes of various sizes, scapel, hemostats, surgical burs, and curved bone-excising forceps.

After the shaping of the arches with the heatless stone, the sockets are clogged with bone debris which should be removed by a gentle curettement of each socket. The muco-perosteal flap is then allowed to take its natural position in order to test its length. If it meets the lingual ridge of soft tissues, it is too long, for there may be a formation of soft spongy or scar tissue on the ridge which would interfere with the stabilizing of the dentures. The ideal condition to be had is a space of about 3 mm. between the flaps and the lingual ridge of soft tissues. This affords the formation of new tissue over the crest of the bony ridge, making the denture foundation more stable.

Only in an emergency are cases sutured, because when suturing is omitted (1) the length of the operation is lessened and the shock to the patient decreased and also the unnecessary work for the operator reduced. (2) Open drainage is most desirable. Ofttimes a small sequestrum of process will be exfoliated and work to the surface and there will be no unnatural force opposing its exit. Then too it is never nec-

essary to remove a suture to allow drainage, should there be a recurrence of infection or suppuration. (3) In the act of smiling, talking, eating, etc., the muco-periosteal flap and the attached muscles are allowed to take their natural position in relation to the arches when there is no suturing. The most that can be said for suturing in these cases is that it is very spectacular.

The above-described technic is used for operating either maxilla or mandible. Not only in cases of full-mouth extraction preparatory to denture construction should the sharp ridges and prominences of bone be trimmed, but it is our duty to the patient and to our dignified profession to consider the extraction of one, two or more teeth a surgical operation and we should perform it as such, using a technic that will give the best results from a restorative standpoint, that will heal in the shortest space of time, and that will give the most comfort to the patient.

In abnormal edentulous mouths where surgical interference is necessary to successful denture construction, it is essential to follow a thoro preliminary examination such as heretofore described, if we are to correctly diagnose the case. Hypertrophied soft tissue is very often found and it must be removed. The cause for its formation should be eliminated if future recurrence is to be avoided. Frequently very low muscular attachments accompany such cases and these also require resection to avoid tipping of the dentures.

Very often a case presents itself in which a denture cannot be worn without considerable discomfort to certain places along the ridge. This usually occurs in the mandible and is caused by a very sharp, knife-edged ridge of bone. Very seldom can this be detected by palpation, but is clearly revealed in the roentgenograms. To relieve this, an incision is made exposing the offending spot and the sharp edge touched with a stone. Healing by first intention usually occurs and the patient can continue wearing the denture with no great discomfort.

I wish to enumerate a few of the many dangers which accompany an operation of this kind: (1) the ease with which too much osseous plate may be removed, thereby loosing retention for the denture; (2) the serious shock that may result from a too lengthy operation or aggravation of the infection in a weak patient; (3) the opening of either or both antra if roentgenograms are not carefully studied (this may easily occur in some edentulous cases where the floor of the maxillary sinus is formed by a very thin maxillary ridge and in those cases of large antra where the floor dips down between the roots of bicuspid and molar teeth); (4) the serious results of hemorrhage in hemophiliacs, if the patient is not carefully questioned.

Before dismissal, following the operation, the mouth is irrigated with a 1 per cent Dakin solution and the patient instructed as to home prophylactic measures. The patient returns to the office as often as necessary for post operative treatments, which usually consist of irrigation, application of remedies to relieve any pain that may result, and dressing of any socket in which dressing is to be maintained.

The average case heals in about two weeks and at the end of the third impressions can be taken with practically no irritation.

The results usually accomplished in surgical preparation of the mouth are very gratifying to the dentist as well as to the patient. Not only is the patient benefited by the correction of facial contour, but also systemically by the elimination of absorption of the bacterial toxine, in the removal of the pathological areas, and by his ability to efficiently masticate his food with the properly constructed dentures.

THE MAKING OF A RADIOGRAM AND ITS INTERPRETATION

By O. E. LAMPHEAR,* D.D.S., Kalamazoo, Michigan

(Read before the Michigan State Dental Society, Detroit, Michigan, April 11-15, 1921.)

THE ROLE of the radiodontist is a constant endeavor to help humanity by the early recognition of the beginning of the ravages of disease, and ofttimes pain, and arresting its progress before irreparable damage is done.

Let me quote from C. O. Simpson in his talk to exodontists:

> The co-operation of men in limited fields of mutual advantage is a great influence in the progress of dental science. We all may learn from men who are intensively studying and operating along lines so closely related as are the specialties of dentistry. Aside from the selfish interest in direct gain, the fraternal spirit promotes technical advancement and the prestige of the profession in the estimation of the laity. The radiodontist in his examinations should consider himself an associate of the orthodontist with the success of the treatment and the welfare of the patient at heart, and should utilize thought and ingenuity to obtain the maximum amount of information.

The same sentiment should apply to work with the dental and medical diagnostician and clinician.

Again to quote from Dr. Simpson's article:

> The appreciation of radiographs which disclose the most information comes from careful discrimination and the extensive use of *them*. To the beginner anything which shows the roots of teeth is such a revelation that little more is expected and the majority of dentists accept without complaint radiographs from which a diagnosis cannot be made. Interpretation is precarious enough with the best radiographic records obtainable and when attempted with less becomes little more than clairvoyance (or a guessing contest). Many men are confident of their interpretations just as all were a few years ago, and some now are, of their root-canal operations.

And so long as we do this kind of film work and are satisfied with making our interpretations from imperfect films we must expect to receive the unwarranted quips and jibes thrown at us by the austere internists and the expert root-canal workers.

Radiodontia is showing a phenomenal development and new problems present themselves to our view daily. We must not be content unless we find in ourselves the ability "to take X-ray pictures." Let us be equal to the internist in our equipment and "professional brains." It should be our endeavor to establish a closer relationship between the radiodontist and each dental clinician, exodontist, orthodontist, rhinologist and internist by whom we are consulted so that we may give the patient the maximum service with the minimum loss of his energy. Is it within the province of the general dental practitioner to adequately deliver all this?

If we wish to merit the confidence of our colaborers we must produce clean-cut work, the films must be of proper size and adaptability, and they must be handled with a technic so exacting in details that the minutest abnormality or pathological lesion is revealed to the keen observer. In our interpretations let us be cautious, but not overcautious; let us be careful but not alarming; let us temper our judgment with experience. The anatomical landmarks must come out in normal and constant relation. We must avoid the type of work which Howard Raper calls "sure shot methods."

I have watched with keen interest the adoption of a standardization of radiodontia, and I look forward to the adoption of the principles laid down by Drs.

*Deceased.

Schell and Spangler in the March issue of the *International Journal of Orthodontia and Surgery.*

While their technic is not necessarily followed as such by W. F. Quinn of Detroit, we will note how closely it parallels their work. If all our contemporaries were as painstaking and skilful we would need only to discuss interpretation and co-operation.

They have covered the technic of producing intraoral films so scientifically and their views parallel my experience that I quote them verbatim. Dr. Molt recently gave Mr. McCormack's technic and terminology. With Drs. Schell and Spangler's technic for foundation we may more readily interlace the other theories of technic, remembering that McCormack has added a "distance technic," a departure both radical and superior to anything it has been my pleasure to test, as well as a technic of his own.

For identification of each film Major Bitely of the United States Army puts a number on the wrapper which is transferred to each film inside with an indelible pencil just before developing. This is an approved identification mark.

There are a few unique accessories I might mention: Heidbrink's aluminum film holder, Buck's molar film, and Dr. Van Woert's film holder which has a wider range of usefulness than any other in my experience. It is scientific and provides accurate means for recording the relative positions of teeth and tube. We can systematically record a reading of the position of the source and direction of the ray. This is useful for multiple and subsequent work. If carefully elaborated it is useful for intra-oral stereo-radiograms. This angle-recording device will also help to develop and maintain a well-thought out intra-oral and extra-oral technic. As long as we are clearing up our technic we will adhere rather closely to Drs. Schell and Spangler's technic.

The basis of our work depends upon the manipulation and integrity of the sensitive silver film, and this shows only three things: (1) change in density, (2) change in form, and (3) change in movability.

The first of the prime essentials is change in density. All densities are relative. This must be faithfully recorded and it must be obvious to the interpreter which technical details were applied to produce these relative densities in order that he may use his mature judgment in determining tone values. While in the highly individualized cases, the ones in which we seek differentiation and diagnosis of a high order, it might be necessary to inquire which technic was employed.

Dr. Molt exhibited some cases showing normal histology and anatomy, but abnormal in minimum density to so marked a degree that with anything but first-class films or to the untrained observer the areas depicted would have been called pathological and operation advised.

Form, as we will discuss it, pertains to normal histological anatomy. Deviation caused by traumatism, delayed development, physiological and pathological, are not to be considered while talking of the production end of a set of standard films. We must establish a basic method which in no way is better than one of several, but which must be individualistic for each worker. If we understand the position in which we take a given set of pictures, we can easily adapt it to our methods.

Undoubtedly most of the practical results in intra-oral work seem to follow the holding of the films or the film carrier by instructing the patient to carefully bite on the fingers while holding the films in position.

Movability is shown in the erupting of teeth, in the healing of fractures and operative lesions, and in the growth of cysts, tumors, granulomas, exostoses, necroses, etc.; all of them require multiple films to show the amount of movement that has taken place in the interim.

There are, then, a number of factors which can be kept constant for every patient, and if the technician will keep them so, much of the guess work incident to the production of good diagnostic films will be eliminated. These factors will be taken up separately, and may be enumerated as follows:

1. Relative position of the tubestand to the chair and to the patient.
2. The sagittal plane of the head absolutely and constantly vertical.
3. The crowns of the teeth lying in a horizontal line.
4. The crowns of the teeth lying in a line parallel to the axis, or the target, of the tube, except when using the "right angle" Coolidge dental tube, when this line will be perpendicular to the target.

Considering the first factor, the relative position of the tubestand to the chair and the patient, it has been found that it is most convenient to place the tubestand at the right of the chair, so that the tube carriage extends across and in front of the patient's head, with the tube turned so that the ray is horizontal. When using special dental units, this, of course, will not apply, but the purpose in presenting this factor is to aid the technician who is not equipped with special dental appartus and must use the regular tubestand. This position for the stand will be found convenient because it will not be found necessary to move the stand during the operations, as the tube may be either raised or lowered or shifted laterally across the face by means of the carriage. Also, the carriage may be swung away from the chair to admit the patient, or to give the operator more room while placing the film.

The sagittal plane of the head is to remain absolutely vertical. If this point is not closely watched—that is, if the head is tilted to either side—the angle of the ray must be changed to conform to the new position, and it would be impossible to state a definite angle for the ray unless the position of the head is kept constant. Therefore, the success of this system will depend upon this point probably above all others.

If the crowns of the teeth are shifted out of the horizontal line, the shadows of the teeth will partly superimpose, thus blotting out some of the structures important to accurate interpretation and distorting the relation of the apices and surrounding structures. Furthermore, the clean-out appearance of the finished film will be destroyed.

For a similar reason this same line (the line of the crowns) must be parallel to the axis of the tube—that is, perpendicular to the normal ray—for if the head is turned so that the crowns of the teeth lie in a line which is not at right angles to the normal ray, the shadows of the individual teeth will superimpose laterally. This factor must be represented diagrammatically.

These four points will remain constant for every patient. Having made these certain, it is possible to proceed with a definite tube angle for each type of teeth, upper and lower, the only indefinite factor remaining to be defined being the points upon which the normal ray is centered in each case.

The following angles and center points have been found satisfactory (it was found necessary to vary them only under very exceptional circumstances).

MAXILLARY MOLARS

1. The sagittal plane absolutely vertical.
2. The line of the crowns horizontal. This may necessitate tilting the head slightly forward, for in opening the mouth to receive the film the head is generally thrown upward.
3. The line of the crowns parallel to the axis of the tube, i.e. perpendicular to the normal ray.
4. Tube tilted 23° below the horizontal, i.e. the ray directed 23° downward. (At this point this technic varies from McCormack's long distance technic.)
5. The normal ray centered on the lower border of the zygomatic and over

the second molar. (McCormack slightly at variance.)

MAXILLARY PREMOLARS

1. The sagittal plane absolutely vertical.
2. The line of crowns horizontal.
3. Line of crowns parallel to axis of tube. This will necessitate turning the face slightly more toward the tube, but care must be taken to see that the sagittal plane remains vertical and that the crowns remain horizontal.
4. Tube tilted 33° below horizontal, i.e. ray directed downward 33°.
5. Normal ray centered between the two teeth and on a line with the lower border of the zygomatic.

MAXILLARY CANINES

1. The sagittal plane vertical.
2. Line of crowns horizontal.
3. Does not apply, but the general line of crowns should be kept as before.
4. Tube tilted 40° below horizontal, i.e. ray directed downward 40°.
5. Normal ray centered over the teeth on a line with the lower zygomatic.

MAXILLARY INCISORS

1. The sagittal plane vertical.
2. Line of crowns horizontal.
3. Line of crowns parallel as to axis of tube.
4. Normal ray perpendicular to the line of the nose.
5. Normal ray centered between the central incisors, over the tip of the nose.

MANDIBULAR MOLARS

1. The sagittal plane vertical.
2. Line of crowns horizontal.
3. Line of crowns parallel to axis of tube.
4. Tube tilted 3° above horizontal, i.e. ray directed 3° upward.
5. Normal ray centered over the second molar just anterior to the attachment of the masseter on the jaw.

MANDIBULAR PREMOLARS

1. The sagittal plane vertical.
2. Line of crowns horizontal.
3. Line of crowns parallel to axis of tube.
4. Tube tilted 10° above horizontal, i.e. ray directed 10° upward.
5. Normal ray centered between the two teeth.

MANDIBULAR CANINES

1. The sagittal plane vertical.
2. Line of crowns horizontal.
3. Line of crowns parallel to axis of tube.
4. Tube tilted 15° above the horizontal, i.e. ray directed 15° upward.
5. Normal ray centered over the tooth, i.e. at the angle of the chin.

MANDIBULAR INCISORS

1. Body erect, head thrown back to an angle about 45°, mouth wide open.
2. Line of crowns horizontal.
3. Line of crowns parallel to axis of tube.
4. Tube tilted to horizontal, i.e. ray directed on a horizontal line.
5. Normal ray centered between the central incisors, at the tip of the chin.

Altho the first three points in almost every case are repetitions, their importance cannot be overestimated, because the success of the entire technic depends upon the strict attention of keeping the sagittal plane of the head always vertical and the crowns of the teeth always horizontal. In order to accomplish the latter in taking the lower teeth it will be necessary for the head to be thrown back considerably, especially when taking the lower incisors. As an aid in retaining these positions a simple form of headrest is desirable, and altho it may be dispensed with if the patient is carefully instructed as to the importance of holding the positions, its use will tend to steady the head and relieve the strain upon the muscles. It is, of course, perfectly permissible and desirable to have the patient shift the position of the body in the chair in order to relieve the discomfort which would otherwise attend, especially where long exposures are nec-

essary, but the operator must be at great pains to see that the relative positions of the head and the tube are not interfered with by changes in the position of the body.

The voltage and current will depend upon the type of apparatus used. A three-inch gap is considered sufficient, backing up a current of from ten to twenty milliamperes. Using this setting, an exposure of five seconds is about an average for upper molars, but the time will vary with the weight, or thickness of the parts. This technic will be satisfactory for use with the regular film, and when extra fast films are used the time will be reduced accordingly. It is found, however, that better results are obtainable with the regular than with the fast films, altho the use of the latter may be advocated in the case of nervous or young patients.

Those using rapid films will enjoy a lower penetration and greater distance with the same time rather than using the regular film technic with short, abbreviated time. This is one secret of McCormack's wonderful technic.

It is advisable to use the index finger of the left hand in holding the films on the right side and the index finger of the right hand for those on the left side, with the thumb for the incisors. The patient should be carefully instructed how to hold the films, and also told of the importance of not letting them slip from the position in which the operator places them. The corners of the films should be bent to conform with the soft tissues, to prevent pricking or gagging.

Finally, the entire process should be performed without any evidence of haste, giving the patient time between each exposure to compose himself in a position as comfortable as possible.

We then pass on to the diagnosis which is not taken from the film except in rare cases, but is made up from many factors, interpretation of the film, the clinical history, laboratory findings, etc., combined. Let us use our decisions tempered with experiences like the following given by Divley and Duke: "One chronic mild infection may influence the course of other chronic mild infections. For example, tonsils that appear to be chronically inflamed often become smaller and disappear relatively after the eradication of severe oral sepsis. Chronic infection of the nasal sinuses may often be reduced in severity or to apparent quiescence by the removal of infected tonsils or alveolar abscesses."

A definite order of routine in classifying cases combined with trained analytical judgment in interpretation, a careful checking with a history chart which was taken before radiographing the subject will build up ability that enhances the value of the opinion of any of radiodontist sufficient to make it very much worth while professionally, providing he has followed his cases to the operating chair.

Does the radiograph show any variation from the standard normal? Abnormal growth? Cause? Lesions? Do these appear to give any symptoms regarding the patient's case? Are the radiographic findings corroborative of the laboratory findings? Do the Roentgen findings agree with the physical findings? Does anything in either suggest a solution of the other? Do they agree with the findings of the clinician or internist?

To one versed in their interpretation and limitations, radiograms are real wonder workers.

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MECHANICS OF MASTICATION IN RELATION TO THE HEALTH OF THE PERIODONTIUM

By ISADOR HIRSCHFELD, D.D.S., New York City

(Read before the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

IN THE realm of periodontia we find various opinions as to the causes of periclasia but they may be placed roughly into three classes: (1) that dental periclasia is brought about by faulty metabolism, inadequate diet, or defective organic functioning; (2) that the predisposition to dental periclasia is mainly systemic and requires only a local factor to inaugurate it; (3) that its etiology is almost entirely local in origin. It is my belief that tho systemic causes may be important factors, local causes are in the main responsible for the beginning and the continuation of the great majority of dental periclasias. Of these local causes the most frequent are of a mechanical character, especially those which result from anatomical variations, natural or artificial, and which produce imperfect co-ordination in the mechanical set-up of the masticating apparatus.

The researches of anthropologists and histologists, describing the developmental processes in the evolution of cusps, grooves, sulci, ridges, etc., in a tooth, lead us to consider the purposes these landmarks serve in the maintenance of human dental economy. The machinist is indeed a poor one who does not know the functional reason for the shape of the various parts of the machine he handles; and we dentists, like the machinists, should at least try to understand the ways of what we might call the functional anatomy of the masticating apparatus, which is really a machine. As such the effectiveness of its work is dependent upon the principles of physics; its durability upon the same principles coupled with biologic elasticity. The term "functional anatomy" is used as a reminder that every contour, fossa, etc., in the anatomy of a tooth has a special function which must be kept in mind when restoring teeth or parts of teeth. In diagnosing traumatic etiology, a thoro knowledge of functional anatomy is indispensable.

In the normal denture, teeth are so shaped, constituted, and placed as to perform the function of mastication with the greatest efficiency, with the least amount of physical strain to the periodontium, and, considering the forceful nature of that function, with the greatest protection to those tissues. Nature will permit but only slight divergences in anatomy without telling effects. Abnormal anatomy causes impaired function which, continuing for a length of time, may overwhelm the biologic factors and the result is disease. In other words, normal anatomy means normal function; abnormal anatomy, impaired function; and impaired function invites a pathologic state.

The teeth at the portal of the oral

cavity separate the morsel from the bulk of food. For this function there are opposing each other two sharply rounded edges each formed by the contiguous alignment of the incisors and canines. These edges meet and the teeth pass by each other in continuous contact, the lower in back of the upper, the axial diameter of the former almost parallel to the imaginary continuation of that of the latter. The distance these edges pass by each other depends upon how soon they

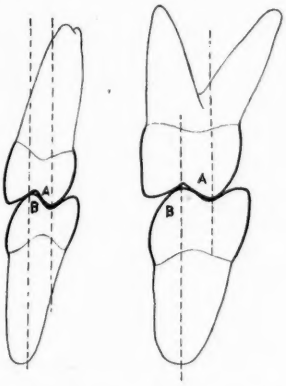

Fig. 1.—A, working cusps of upper posterior teeth; B, working cusps of lower posterior teeth. The highest points of these cusps are situated inside the base formed by the respective buccal and lingual borders of the alveoli, thus bringing to a minimum leverage during mastication.

are stopped by the occlusion of the posterior teeth. Where the latter are missing the incisors take on a strain which is greatly in excess of that which nature intended for them, with the result that the uppers are forced forward by the unyielding labial convexity of the lower arch. The convexity of the lower anterior arch forcing against the concavity of the upper will result in forcing labially the individual teeth in the upper arch, for the contiguity of the lower, helps to make it almost impossible for any of them to be forced lingually to the arch. The physical action performed by the posterior teeth in mastication is mostly one of crushing between a series of convexities gliding over one another. The intervening sulci at the coalescence of their bases are necessary for gripping purposes in trituration. Any anatomical deviation from this means undue strain on investing tissues.

Facets and concavities on occlusal surfaces are not original anatomical characteristics. They are produced by wear and are inimical to proper functioning both mechanically and physiologically. The mechanics of convexities as crushing surfaces may be explained as follows: with a given pressure the intensity varies inversely as the area; in other words, the smaller the pressure area the less pressure will be required to crush a substance and hence comparatively little strain is exerted upon the original anatomical convexities on the occlusal surfaces. This, of course, reduces tendency to trauma. When occlusal surfaces or cusps are worn flat and the sulci partly or wholly obliterated, the pressure required in mastication is very much increased, first, because of the enlarged surfaces of occlusal contact and, secondly, because of the loss of the gripping efficiency of the sulci. When the cusps are too long and tend to limit the lateral (horizontal) movement of the mandible, an excessive strain is produced on the periodontium.

The working points of incisors and canines are almost always directly in line with their long axis, with the result that the leverage is reduced to a minimum. This relation holds true, practically, also in the bicuspids and molars. The buccal cusps of the lower and the lingual cusps of the upper posterior teeth perform the hardest work and act as pestles in the mortars formed by the occlusal fossae of the opposite teeth. The

highest points of these cusps are situated inside the base formed by the respective buccal and lingual borders of the alveoli. Because of their centric position these cusps undergo the greatest amount of wear during the process of mastication and consequently disappear, while those cusps which are in eccentric relation during mastication are worn only partly by the same mechanical action, to the extent of producing an oblique concavity from the base of each cusp to its point. The cusps so modified overlap their opponents

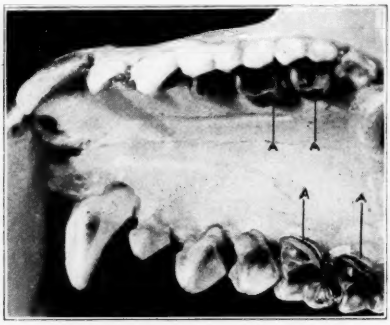

Fig. 2.—A, ledge extending from lingual side of molars and superimposed immediately over gingival crevice, apparently for its protection against trauma. (Photograph by the American Museum of Natural History, New York).

to an accentuated degree, and we now have potential traumatic leverage.

Functional anatomy of a tooth loses its efficiency and its purpose is defeated thru malposition of the tooth in relation to the arch, or to the adjacent or opposing teeth. Protective anatomy of teeth warrants consideration not less than their anatomy with reference to their masticating efficiency. Two years ago, Dr. Friesell presented a most able discussion of the protective anatomy of the teeth. I will attempt, however, to amplify on one or two of his statements. When we examine the histology of the frail lining of the gingival crevice we find that it consists partly of a single layer of epithelium with occasional breaks in it particularly at the cemento-gingival junction. This lining requires physical protection and nature offers that protection in two ways: (1) the sphincter-like tightness with which the normal, thin-edged gingiva hugs the tooth; (2) the incline at the height of contour which causes the food to glance off and strike, directly or indirectly, the cornified external surface of the gum. These provisions prevent traumatic impaction of food against the delicate floor of the gingival crevice.

The first form of protection was nicely illustrated in slides presented last year at a meeting of the First District Dental Society of New York. They showed mouths in which all the gingivae displayed marked pathologic conditions except over teeth bearing porcelain crowns. The lecturer of that evening stated, incidentally, that the dentists in his locality, when placing a porcelain crown, avoid protruding cervical margins of either crown or root by grinding both at their junction. It is evident that a greater construction at the neck is thus produced. One can readily understand how the contractile marginal gingiva will adapt itself into this constriction, and the resultant greater shoulder caused by the same operation automatically emphasizes protection to the gingival crevice. The most extreme instance of the second method of protection that I have observed is in the molars of the lemur, a species of the monkey family. We find here an actual ledge built right out and superimposed over the gingival border, its protective purpose being very evident. This tendency toward protective provision, variously modified, may be seen in teeth of most animals.

The height of contour as described

by Dr. Friesell is, however, not without disadvantage; for while it eliminates mechanical injury to the gingivae during mastication it invites chemical and bacterial irritation to that tissue, especially in the mouths of people whose diet consists largely of soft, pasty foods. The surface of the teeth beyond the height of contour, nearest the gingival border, where it is neither cleansed by mastication nor swept by the tongue and cheeks, becomes a safe place for the lodgment of

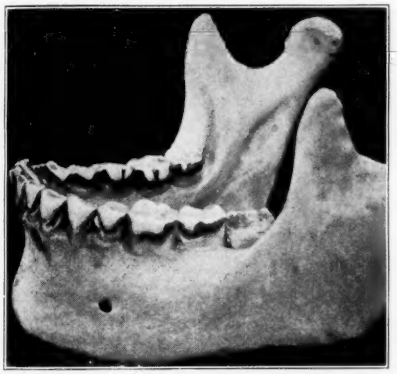

Fig. 3.—Mandible of a Hindu skull showing discoloration of teeth beyond the "height of contour," caused by habitual chewing of betel nut. This area is equivalent in our mouths to the unclean zone produced by improper food and lack of thoro toothbrushing. (Photograph by the American Museum of Natural History, New York.)

food and bacterial cultures. This unhygienic condition results in sensitiveness and erosion and often inaugurates pathologic processes in the peridental tissues at that point. This fact should be explained by the dentist to his patients in the course of instruction in mouth hygiene, using disclosing solution as corroborating evidence. The importance of thoro and careful use of the brush on this area should be emphasized.

In referring to the mesio-distal approximation of the mandibular to the maxillary denture, Tomes says: "By this admirable arrangement no two teeth oppose each other only, but every tooth in closure of the jaw impinges upon two, so that should a tooth be lost, or even two alternate teeth, still the corresponding teeth of the opposite jaw are to some extent opposed, and thus remain useful." We should take very little comfort in the apparent provision described in this statement. When found in as excellent a work as Tomes's *Dental Anatomy* that quotation is seriously misleading to the

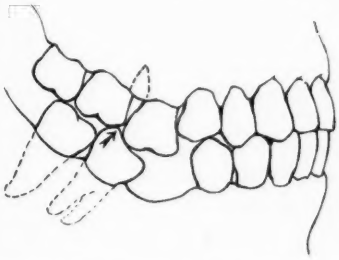

Fig. 4.—Diagram of a condition met with in everyday practice, the result of failure to replace an individual missing tooth. This abnormal condition is caused by lack of mesio-distal support and almost invariably leads to dental and periodontal disease.

recent graduate, as it produces an everlasting impression of safety upon his mind. It permits the most conscientious of them to advise the patient not to have individual teeth replaced in the posterior part of the mouth. They honestly believe that there will be no harm done by letting well enough alone and that in attempting to replace the missing tooth they would encroach upon the integrity of the two healthy teeth adjacent to the space. After a series of changes, we find in a few years a disarranged line of occlusion which hinders the teeth from functioning in co-ordination, a condition which predisposes dental periclasia. The

consequences of allowing the space to remain after the extraction of a tooth are most extreme and can be best observed in the case of a six-year molar. They may be enumerated as follows:

1. Leverage and food impaction produced by mesial tipping of the lower second and third molars.

2. Distal tipping of teeth mesial to the space.

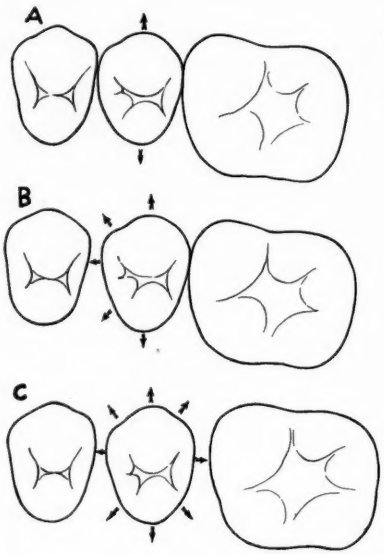

Fig. 5.—A, normal mesio-distal contiguity, the individual motion of the teeth is therefore buccal and lingual; B, lost contiguity either mesially or distally allowing movement within an arc of half a circle; C, lost contiguity both mesially and distally allowing free movement in a complete circle.

3. The extrusion of the upper first molar resulting in:

a. Increased leverage.

b. Interproximal contact which normally is biconvex becomes concavo-convex, a condition inimical to a hygienic state.

c. The cementum is exposed and is easily attacked there by chemical and bacterial action.

d. The greatest mesio-distal diameter which normally terminates at the contact point and helps to keep the entire arch properly lined up drops down with the lowering of this bell-shaped molar. As a consequence the shorter diameter at the new contact point tends to cause a general disarrangement of the normal mesio-distal approximation.

e. A funnel is formed between the protruding distal surface of the elongated tooth and the mesial inclined plane of the mesial cusps of the second upper into which food is invariably compressed, the lower second molar acting as a plunger.

f. A pocket started by food impaction will very shortly reach the almost exposed bifurcation on the distal side of the upper first molar. This very often necessitates extraction of that tooth.

During function, teeth in normal contiguity move mainly bucco-lingually and slightly into the depth of the alveolar socket, the movement being controlled by the principal fibers of the pericementum. Mesio-distal movement is almost zero on account of the contiguity, a fact that is important because it prevents food impaction and its pathological sequelae. Normal movement of the teeth results in a physiological stimulation in the periodontium, but when a tooth is forced outside its normal radius of movement, we have what Dr. Stillman so ably described and termed "traumatic occlusion."

The subject of traumatic occlusion is so vast that this paper can touch upon but one phase of it which, to my knowledge, has not been emphasized up to the present time. This particular phase is of such importance that we cannot afford to ignore it. It does not occur between the teeth directly and cannot be detected by the use of articulating paper; yet, with a hard morsel of food, such as a crust of bread as intermediary, occlu-

sion becomes traumatic and results in exactly the same pathologic phenomena in the periodontium as in the direct traumatic occlusion, since here also the tooth involved travels outside its normal radius of movement. This form may be termed indirect traumatic occlusion.

Summary of Conclusions

1. Teeth are so formed and placed by nature as to function most efficiently and to help maintain a state of health in their investing tissues; therefore dentists should think of tooth form in particular and of the masticating apparatus as a whole in terms of functional anatomy.

2. Whether or not an existing deviation from the normal in the anatomy of the masticating outfit has been the exciting factor in a peridental disease, the prognosis will be governed to a very great extent by the possibility of correcting that deviation.

3. Concavities and facets on occlusal surfaces are acquired, not original, and are physically inimical to the health of the periodontium, while normal occlusal surfaces present convexities which are physical assets to periodontal health.

4. Protective form of teeth is most essential but it has a tendency under modern diet to create a zone immune from the scouring effects of mastication. The importance of the correct use of the tooth brush in this area should therefore be impressed upon the patient during instruction in mouth hygiene.

5. Neglect to replace as soon as possible even a single extracted tooth may disarrange the entire masticating machine to the extent of eventually resulting in a general dental periclasia with its possible serious consequences to the entire organism.

6. An indirect traumatic occlusion is produced in some instances by a hard morsel of food as intermediary where otherwise occlusal trauma does not exist.

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Discussion

Percy Williams, New York City: The essayist has stated that there are cases where the sulci are so deep and the cusps so long that the jaw becomes locked. Do I understand that correctly?

Dr. Hirschfeld: Where the cusps are abnormally long, as you will often find them, they will tend to limit the lateral movement of the mandible, which is inimical to the health of the periodontium.

Dr. Williams: I cannot agree with that, because it seems to me that you do not have the full stress of the muscles pulling on the mandible at the instant the cusps leave the sulci in a lateral excursion. When in the act of chewing the mandible passes, we will say, to the right side and the buccal cusps meet end to end, there is a very slight relaxation of the muscles. As the cusps go back into the sulci, there is a strong contraction of the muscles and the food is thus crushed and ground. It seems to me that the slight relaxation of the muscles in giving a lateral excursion of the mandible will allow the cusps to pass out of the sulci and a lateral movement of the mandible will be possible in cases of normal overlap, with the full function of mastication being exercised. In such a case a patient could chew most effectively, even tho he may have abnormally long cusps. Of course, if he has long cusps he will have deep sulci, as the sulci is in direct ratio to the length of the cusps.

I have been so intensely interested in Dr. Hirschfeld's presentation that I want a little elaboration upon that statement. It seems to me that he has brought out a very vital principle, that unless there is a uniform amount of wear upon all the teeth pathological conditions are almost sure to be brought about. If you start with an abnormal overlap—and this is a principle which the general practitioner should be always ready to observe—as wear takes place upon the molars and bicuspids, an abnormal stress is thrown upon the front teeth, and this stress is brought to bear upon the anteriors at a time in the patient's life when there may be favorable conditions for pyorrhea. When one is about thirty years of age often a separation of the centrals is

observed due to the stress being thrown upon the front teeth because of the abnormal wear on the molars and bicuspids. The remedy for that is to bring about a uniform amount of wear artificially on the front teeth, so that the stress is again thrown back to the posterior teeth, where it belongs.

Occasionally I have patients come to me for orthodontic treatment who have centrals that have been separated—I am referring of course, to adults. These are cases where the stress of mastication should be put back upon the posterior teeth, and then, after the cause has been removed, orthodontic treatment may be the correct thing to do, but certainly no attempt should be made to draw the centrals together while stress is throwing them apart. A space has been caused there because of abnormal stress, so that the remedy is to grind the front teeth and remove the stress of the incisal edges of the lowers against the palatial surfaces of the uppers. I have a patient about thirty years of age, to whom I advised devitalization of the upper centrals, so that they could be ground until they were entirely free from stress, and a movement posteriorly became possible. Unless this is done and the stress is removed, I do not see any salvation for teeth in this condition. I think they will certainly be lost. The essayist has shown us most clearly that this is a vital principle which we must always bear in mind. I am, of course, referring to cases where all of the molars and bicuspids are *in situ* and occluding normally. If teeth are missing or there is a loss of tooth structure, the occlusal plane must be restored.

E. S. Calder, Providence, Rhode Island: I have had some little experience with older people, who have ground their teeth down by the chewing of coarse foods and have come to me with the lower incisors in a very bad state of inflammation, with the gums starting to recede, and I consulted with two or three other practitioners as to the best procedure in those cases. Some told me to grind the teeth on the lingual surfaces, which would take off the sharp edges and stop loosening the teeth in that way, and some suggested the crowning of the teeth. I have in mind five cases where I have raised the bite on the older teeth by the use of inlays, making them out of an alloy, B gold. At the present time these five men have not changed their habits; they eat very coarse food and I imagine some of them chew tobacco. In all cases pyorrhea and inflammation and loosening of the teeth have disappeared entirely. I have confined the inlays to the back teeth, except in one case, where I had to fill the tops of the eyeteeth with gold, because they were getting a little sore, but I have not put anything on the front teeth. By removing the bite from them and putting it on the back, and reproducing the occlusion that was present before they were all worn down, I have obtained a normal mouth in each of the five cases.

Dr. Hirschfeld (closing): A relative of mine was treated for a periclasia about fifteen years ago, and I remember very well that as much traumatic occlusion as possible was removed wherever it was found. This patient got along very nicely, with comparatively few prophylactic treatments during this interval; but it was only about three years ago that signs of marginal inflammation became manifest in her mouth and I tried to do everything I could to restore the gums to normal in color. I did not succeed and that was one of the reasons that led me to believe that during the great lapse of time the teeth had worn down more or less flat as I have described here. I have tried to restore them by bringing the highest point of occlusal contour as nearly as possible within the base formed by the borders of the alveoli, and it seemed as if that helped considerably after other things had failed.

FINANCING MOUTH HYGIENE

By HARRIS R. C. WILSON, D.D.S., Cleveland, Ohio

(Read before the National Dental Association, Milwaukee, Wisconsin, August 15-19, 1921)

IN THE early attempts to demonstrate mouth hygiene the necessary funds were universally raised by donations from members of the dental profession or from the treasury of a dental society. After many years of mouth hygiene the dental profession has come to feel that the public should bear this expense and that the dental profession should bear only its share as members of society.

Any new idea must "be sold" to the public by those who know the value of the idea, that is, it must be demonstrated and then brought clearly to the attention of the people and so often that they, the people, realize what the idea means to them. The value of mouth hygiene has been pretty well sold to that portion of the people who think about health, and the dental profession has paid the necessary expense in money, time, and effort. The leaders among educators now appreciate that the expense of teaching mouth hygiene and of mouth hygiene service should be met by all alike just as arithmetic is taught and the school teachers are paid by society from common taxes.

When a service has been so well and so long established in the minds of the masses as to be accepted as a necessary part of community life, such as a fire or police department or a public library or public school, the money to pay for the same is raised by taxes and all residents of the community pay in proportion to their individual ability.

There are a certain number of activities which we all admit are desirable *if* we are brought into intimate contact with the need and are thoroly impressed with the efficiency of the solution offered. Such activities as homes for children, hospitals for cripples, fresh air camps, old age homes, aids to unfortunates, and many other social, health, civic and recreational activities are in this category and have for some years past been supported by private donations from a few interested people. In Cleveland more than one hundred organizations have each had their own group of financial supporters and their few active workers. Some of these activities have reached large dimensions and are annually using considerable sums of money. This necessitated a number of campaigns, begging money, which became rather a burden and also very expensive for the community. The plan of federating several agencies so that one campaign would answer for all was developed with the final result that after the war campaigns the community fund idea was rather highly developed in the minds of many people.

Two slogans have been most effective in the publicity part of these campaigns. "Give once but enough for all" has a strong appeal to one's best judgment.

The slogan "Suppose nobody cared" had a strong appeal to the sympathy and did the trick of loosening the purse strings.

In 1920, Cleveland raised in one campaign over four and a half million dollars; this to finance all our home agencies and to do our quota in aiding foreign relief and some national agencies in America. These campaigns are intensely interesting and really absorb much of the public thought for a week or ten days. Window exhibits in the most valuable downtown store fronts are attractive and of much educational value. The work of the blind is exhibited and a blind worker actually works in view of the street throngs. Dolls are dressed and undressed to demonstrate the correct American method of dressing a baby. Red Cross work is given a prominent place. Hospital care and homes for orphans, cripples, etc., are demonstrated along with fresh air camp and Boy Scout activities. Mouth hygiene has its place along with feeding the undernourished and incipient tubercular child. These things educate and at the same time produce the effect of loosening the purse strings. Such a campaign necessitates a very careful preparation of a budget for each agency and all budgets should be and are harmonized to the end that each agency is supported in just proportion to all others in respect to the community need for each particular service.

When an organization has to prepare a budget for a year in advance it means that some clear thinking must be done as we cannot guess and dream for we must be able to show why we ask for just so many dollars for each of twenty or thirty items composing a budget. All this means that you must have a well-organized group of interested supporters of an idea who are willing to give some considerable time and a little money for the good of humanity. In establishing mouth hygiene or any social health activity the founders should be those who are heart and soul in the work and are willing to sacrifice much. Such groups are of necessity small in size for only a few humans are truly socially minded. Once gathered together with a definite purpose in mind these people should formulate carefully a statement of the object of their mutual endeavor. An object once reduced to writing the next step is an organization and it should be incorporated. A high-grade lawyer, socially minded, should be educated to the value of your idea until he is willing to give of his time and service to handle the incorporation without fees. He should be one of the trustees of your association, for he will be of value by bringing another viewpoint into your deliberations. You will probably have some property to start with, inherited from early activities, which may be your material backing. Once incorporated and organized you are ready for federation with other local organizations doing community work. Avoid including in a federation any agency that is purely religious or political in character. No discrimination should be made as to black or white, Protestant or Catholic, Jew or Gentile, for we are all human beings and living in the same environment. We are subject to the same misfortunes and handicaps. None of us are exempt from the possible need of help from our federated agencies. Many organizations are supported by religious sects that are doing a purely social piece of work, such as homes for the aged, homes for children, infants and cripples. These should be in the federation.

One of the greatest returns from this movement is the bringing together of all kinds of people in a common cause. We have taken a step forward in human

progress when Jew and Gentile, Catholic and Protestant, black and white, can all work for one object and all give of their earthly goods to a common fund. The individual giver has the satisfaction of knowing he has donated to all the worthy activities and he knows that his money will be spent as intended and will be conserved far more carefully than he himself could do.

This plan of federation is working so efficiently and economically for society that we believe it is a permanent method of handling the less generally understood social activities; therefore, we recommend to you that mouth hygiene associations federate wherever possible.

The time of the worker in any federated social activity will be spent almost entirely on service, and only for a week or two at the time of the annual campaign will you think about raising money. That week or two will require "all hands on deck" for strenuous solicitation of funds, speeches before all civil organizations and volumes in the public prints. Every one must contribute his 1 per cent and then work for money for a few days; then back to service with the satisfaction of one job well done and a reasonable certainty of a year of unhampered service to society ahead of you.

If each person earning money in a community will contribute 1 per cent of his annual income to a community fund the social services of that community may be well financed and it will be a great economy for the community.

As the services financed by a federation become a more fixed and generally recognized social need we expect that they will be taken over by municipal government and operated as today we operate our police, fire, water, court and hospital activities.

Let me add that mouth hygiene is not a thing by itself. It is only a part of a great health movement that is sweeping this world. Intelligent people are everywhere coming to realize that mental education without health and health education is of transient value, and, further, we realize that one health activity carried on independently will accomplish very little; but on the contrary, if we advance each and all health activities in their proper relation we may expect remarkable results in the next generation.

THE TREATMENT OF EDENTULOUS JAWS TO OBTAIN MORE EFFICIENT DENTURE SERVICE

By G. WALTER DITTMAR, D.D.S., Chicago, Illinois

(Read before the Illinois State Dental Society, Peoria, Illinois, May 10-12, 1921)

I WILL attempt to discuss but two phases of this subject: (1) surgical treatment, (2) mechanical treatment.

A small percentage of edentulous mouths requires surgical interference to place them in the best condition to wear artificial dentures. Unfavorable muscle attachments may at times be corrected surgically and materially help to make the dentures more efficient. Extremely uneven absorption of the alveolar process often is a decided handicap to both the patient and dental prosthetist. Here again proper surgical interference will be helpful. Bony enlargements (exostosis) of the hard palate or the lingual surface of the mandible may in rare cases need to be removed to obtain a better condition for artificial dentures. Extremely large tuberosities may need to be reduced and other unfavorable defects, deformities or pathological conditions may be treated surgically. Immediately after extracting teeth, cases often present where the smoothing of the crest of the alveolar process—slight reduction of the bony interproximal septi—such as would, if left, be a source of irritation and retard healing and where a number of teeth that approximated each other were removed the suturing of the gum flaps is unquestionably good practice, providing there is no serious infection. Occasionally, too, curettage is indicated where a necrotic condition exists or where the recuperative power of the patient is by some systemic derangement unquestionably impaired.

I desire, however, to voice a vigorous protest against an unfortunate and almost criminal practice indulged in by pseudo-oral surgeons and some "exodontists," and the like, viz., the *abuse* of the practice of the so-called "surgical removal of teeth." The irreparable harm that these men do by extensive curettements—the breaking down of the labial and buccal alveolar plates of process, the perforation and infection of the maxillary and other sinuses, the diffusion of bacteria into the system generally, with the final unfortunate dwarfed and contracted base for an artificial plate denture—is a menace so serious that the profession must awaken and "stamp it out."

The leading oral surgeons in our profession—teachers, authors, men in whom we have implicit faith—have been teaching conservatism. They condemn this extreme, insane radicalism. The following is from the President's Address of the Institute of Medicine of Chicago, by Dr. Thomas L. Gilmer.[1]

> There has been much unwarranted spectacular operative procedure called "surgery" which removes all adjacent osseous tissues in connection with removal of abscessed and pyorrhea affected teeth. In some cases where there has been extensive bone destruction, operative procedures may be indicated but ordinarily the removal of the tooth suffices. The examination of 2,000 radiographs of edentulous or partially edentulous jaws taken for me in my clinic and private practice in which no curettement or surgical procedures had been observed revealed only three alveolar abscesses which had persisted after the teeth had been removed.

[1]Also published in *Jour. Nat. Dental Assoc.*, VIII (June, 1921), 436.

Leading dental prosthetists also protest the dwarfing of the base area for artificial dentures except in those cases where for pathological, aesthetic or mechanical reasons such surgical interference is necessary.

I desire to present a method which was demonstrated to me some months ago by Dr. George E. Everett, of Chicago, which makes it convenient and easy for the prosthetist to keep artificial dentures in a reasonable state of efficiency. This I have termed mechanical treatment. I will confine my remarks primarily to the proposition of rebasing the denture to keep it fitting as well as possible.

The absorption of the alveolar ridge and the changes incident thereto make it necessary to take a new impression whenever the denture becomes loose and troublesome to the patient.

The technic and materials developed during recent years for taking impressions have without question had more to do with the progress made in artificial denture construction than any other of the numerous elements which enter into this important part of our service.

We have now the end results of the work and investigations of such great prosthetic teachers as Bonwill, Walker, Gritman, Snow, Kerr, Christensen, Gysi, the Green brothers, Hoff, Wilson, Prothero, Goslee, Roach, Williams, Hall, Supplee, House, Tench, Monson, and many others. Humanity and our profession owes a great deal to all of these men.

These investigators, authors, and teachers have advocated for the first important step in denture building, viz., taking the impression, such materials as bees' wax, plaster of Paris, modeling compound, com plaster, and the like. All of these properly used have given excellent satisfaction.

To properly carry such materials and confine them in a manner to copy in detail parts necessary, impression trays of many kinds have been devised. The ultimate object sought is a true reverse copy of the tissues when the mouth is closed in normal occlusion, and stress as in biting is applied.

The first important requisite for this technic is an impression tray which practically fits. If the patient has never worn a plate, take an ordinary good plaster impression, make a "cast" and wax base plate; converting the latter into a vulcanite base by using some quick vulcanizable rubber like Dougherty's twenty-minute rubber. This will make an excellent tray. A modeling compound rim can be securely attached for an occlusion rim, or the artificial teeth may be so attached, and with this tray properly trimmed proceed to take the impression. Graft's Base Plate Material nicely fitted to the plaster cast and properly reinforced is a quicker and reasonably good method for making a tray.

The real impression is now to be taken in wax—a special denture impression wax, which Dr. Everett calls a fluid impression compound and which is prepared in three consistencies, soft, medium and hard.

If the patient is wearing a plate or plates that no longer fit properly, such plate or plates should be used as trays for taking the impressions. I will describe the technic for an upper, using the loosely fitting plate for the impression tray. First scrub the plate with some good kitchen cleanser and a stiff brush. Then swab the inner surface and flanges with chloroform, (be certain that it is perfectly clean and dry and slightly warm).

If the base of the denture is not sufficiently large, the flanges not high enough and the distal too short, enlarge by adding Kerr's Perfection Modeling Compound. As this is an important requisite, I will briefly describe the procedure. Use the stick form of Kerr's Compound. Melt the end of the stick in Bunsen flame and fuse to denture base

where deficiency exists, to the crest of the flanges and to the distal part of the palatal portion. After adding the compound in this manner immerse the plate in hot water, about 160° F. This will uniformly soften and temper the modeling compound.

Remove plate from hot water and place in the mouth. Have the patient occlude and hold plate firmly in position, then have patient swallow several times and muscle trim by forcibly working the lips and cheek muscles; then muscle trim by having patient open mouth, firmly hold tray in position and have patient forcibly work lips and cheeks. Chill compound and remove plate.

If there is an excess of modeling compound cut it off with a sharp knife. Heat the surface in small Bunsen flame and hot water, as before indicated, and again place in patient's mouth. Have patient again occlude, swallow, and muscle trim.

If there is a deficiency of compound add more and treat in like manner. The object sought is to have a tray that will confine the impression material and force it reasonably close around the periphery, labially, buccally, and distally.

The flanges must not be too high, however, nor the palatal portion too long. The latter must extend slightly onto the soft palate. If the compound is nicely adapted there will be a fair peripheral valve seal and the plate will "stick."

We are then ready to take the wax impression. The wax should be heated in a tin container placed in a double boiler and made fluid. The wax containers are placed in the inner part of the double boiler, the outer part holding water which is heated to the boiling point and kept boiling.

The plate or impression tray is again washed, dried, swabbed with chloroform and warmed to the mouth temperature.

With a long handled "hog hair" brush about three-sixteenths inch in diameter apply the liquid wax to the surface of the tray, painting it on, coating the entire palatal surface and inner surface of the flanges, the crest, the labial and buccal surface of the flanges, and lingual end of palatal portion with the medium wax.

If part of the wax has cooled and has become too stiff, carefully soften the waxed surface over a current of steam coming from the double boiler; then quickly place impression tray in patient's mouth and have him occlude, holding the plate firmly; then have him swallow several times and muscle trim.

After holding the tray for five or ten minutes firmly in position, chill with cold water and carefully remove. It is sometimes hard to remove the impression even at this stage without danger of distorting it. Have the patient assist you, if possible, by forcing air under the impression. Have him hold the lips tightly together and forcibly fill mouth with air so as to fully distend the cheeks. Coughing with the mouth closed sometimes accomplishes the desired effect. If these efforts fail to loosen impression, have patient open mouth, grasp plate in region of first molars with two heavy right-angled hoe excavators and manipulate to loosen the impression, carefully removing it from the mouth.

Wash the impression with cool water and examine. It will most likely show a deficiency of impression material in some places. If a deficiency is detected dry the impression with air and add more of the medium wax in the manner before described. Hold the impression over a current of steam in a manner to slightly soften the entire waxed surface and again carefully insert in patient's mouth; have patient occlude, swallow, and muscle trim, again holding the impression firmly under biting stress for a few minutes. This will cause the wax to flow and adapt itself to the tissues.

Chill again and remove as before described. It will no doubt be more difficult to remove it than previously.

After removal wash again and examine. Dry with cool air and apply a coating of the *softer yellow wax* to the entire surface of the impression. Again carefully project in a cloud of steam and then quickly place in patient's mouth. Follow by the occluding, swallowing and muscle trimming operation and again remove and examine. If a deficiency of impression material exists add more and if there is an excess, cut it off with a hot knife. Place the impression in the mouth and if necessary let the patient wear it for an hour or two, instructing him to occlude on it repeatedly. It is best, however, not to have the patient eat with it because the wax is likely to become softened too much and flow to a degree to spoil the impression, especially if the patient should eat or drink hot food. Just before removing the impression the last time it is a good precaution to have the patient hold cold water in the mouth for a couple of minutes so that the wax will become chilled and hardened. Then test the impression for retentive qualities and if satisfactory, carefully remove as before instructed. Should the plate not "stick" as desired, another application of the softer wax around the periphery will produce a new valve seal and cause the impression to "stick." It is necessary to take the impression under biting stress; therefore, if too many natural occluding teeth are missing, a substantial balanced "bite plate" must be placed on the opposing jaw so that balanced and uniform occluding pressure can be applied.

The next operation is to make a cast, preserving the detail of the crest of the buccal and labial flanges.

After the cast has hardened, smooth the wax on the labial and buccal portion of the flanges; also on the distal of palatal portion. Invest in vulcanite flask and proceed with the rebasing operation. Relief must of course be provided on the cast where hard areas in the palate indicate.

Wax is an ideal impression material when confined to this technic. The fact that it does not harden so quickly as do the other impression materials and that it flows and equalizes the stress on the tissues when the patient wears the impression denture for an hour or two is a decided advantage.

For lower impressions the technic is practically the same. Prepare the tray or plate so it will have as large a base as is consistent with the conditions and take the impression with wax, using the medium and hard instead of the soft and medium, tho at times where the tissues are very soft and flabby or where greater detail is desired the soft wax is indicated.

While this technic may seem like a tedious and time-consuming process, I assure you the results are well worth the effort. The comfort the patient enjoys and the time the dentist saves in making subsequent adjustments, together with the general satisfaction to all concerned, are more than adequate compensation for the time and effort spent.

Thus instead of resorting to excessive surgery and reducing the alveolar processes to any great extent, cutting away tissue which it would take years to absorb naturally, it is far better to *rebase the dentures frequently,* and for this in particular Dr. Everett's technic and denture impression wax are unusually good.

ORAL DIAGNOSIS: CLEANING UP A DISEASED MOUTH

By ELMER S. BEST, D.D.S., and CARL W. WALDRON, M.D., D.D.S.,
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(Read before the National Dental Association, Milwaukee, Wisconsin, August 15-19, 1921)

IN PRESENTING this article it is assumed that the reader is familiar with *The Application of Case Records to Dentistry* (1). It is our firm belief that in routine procedure *no treatment should be commenced until the operator has made a careful diagnosis* based upon: (1) the patient's history; (2) a careful clinical examination of the teeth and investing tissues, including vitality tests and the determination of traumatic occlusion; (3) study casts; and (4) a standardized radiographic examination of the mandible and maxilla.

With our diagnosis complete, we are then confronted with the problem of attacking the various sites of disease in order to establish a healthy basis for restoration of function. The manner in which this is done may easily determine the degree of our success. The following order has proved to be a most satisfactory one: (1) oral prophylaxis and instruction in oral hygiene; (2) extraction of teeth and eradication of diseased pericemental and periapical tissues; (3) treatment of infected dentin (an operation for maintaining the vitality in carious teeth); (4) correction of traumatic occlusion; (5) root-canal operations; (6) root and alveolar surgery (scaling and polishing of root surfaces and trimming of margins of alveolar process).

Oral Prophylaxis

In a case where salivary or serumal calculus, food debris and desquamation of mucosa, constituting a markedly insanitary condition are found in considerable quantity, we must begin at once to release the load on the local tissues and start a sanative process. This is done by the removal of this material and cleaning the teeth. This is not the work of the dentist, but should be performed by the dental hygienist. In this connection it must be borne in mind that considerable harm may be done by injudicious use of instruments. Hence only hygienists qualified and well trained in this work should be permitted to render this service. When this has been accomplished, the patient should be thoroly instructed in the home care of the mouth by the hygienist. This includes detailed instruction in the use of the brush and floss.

The introduction of the correct use of the toothbrush: In the resolving of disease and the restoration of tissue tone, the toothbrush is a most important factor. It is amazing how few people understand just what can and should be done in maintaining oral health by the correct use of the toothbrush of the proper type. It might be well to bear in mind that there is a difference between the method of brushing advocated for an adult patient suffering from dental periclasia and that advocated for a young child.

In order that the efficiency of the care taken by the patient may be recorded,

it is necessary that the condition of the teeth and investing tissues be noted at each visit. Incidentally, this affords an excellent means of awakening the interest of the patient in the importance of a clean, healthy mouth. The dentist should not be discouraged if it takes some patients a year to "unlearn" certain habits in the care of the mouth and thoroly master more efficient ones. To assist in this, a diagrammatic report is given to the patient at each visit. This shows them very clearly what areas they are failing to reach.

All patients who have a tendency to dental periclasia *must be given to understand very clearly* that success in handling their case depends more than 50 per cent in the care they give their mouths each day. *Treatment of the disease cannot be left to the dentist.* Periodic visits to the dentist to have teeth "cleaned" will never accomplish this. It must be the daily work of the patient.

The Surgical Removal of Periapical and Pericemental Infection

Complications incident to removing teeth are greatly minimized in a mouth which has been prepared by a preliminary cleaning. The removal of infected areas contiguous to diseased teeth lightens the load on the general system and the local tissues respond more readily. It should be borne in mind that so-called "pulling teeth" as an entity where we have well-established apical infection has a very limited field as an operation. As a general rule teeth are removed in order that periapical areas of diseased tissue may be cleared up. It is assumed that judgment will be exercised in this respect and that mouths will not be placed in such a condition that the prosthodontist will be unable to satisfactorily construct his appliance, whatever it may be. Hence it becomes a surgical operation that calls for great care and precision in operating. The fact that simple extraction of infected teeth in sick people, particularly heart cases, is frequently followed by severe reactions of pulse, temperature, etc., and sometimes death, whereas by the adoption of free methods of approach and careful curettage, such complications are extremely rare and fatalities practically unknown, should give us pause in this work. We should realize that procedures that are so vital to the health of sick people must be of advantage to the well. Furthermore, we should thank kind Providence which in times past has so well protected the larger percentage of our patients from any untoward consequences.

In well patients the dento-surgical problems are as a rule easy of solution. Non-vital teeth showing well-filled canals with no evidence of apical infection are retained if essential to or sacrificed if interfering with the most satisfactory plan of restoration of the function of mastication.

Teeth showing periapical infection are considered a "load on the patient's system" (4), and are surgically removed. In the case of anterior teeth, root-end resection with careful curettage and removal of all infected tissue is occasionally indicated in lieu of extraction. This only, however, in cases where cosmetic dental restorations would involve extensive sacrifice of tooth structure of adjoining teeth or where their removal would necessitate a denture. The retention of such teeth may be essential in the case of singers or public speakers. The decision hangs on the resistance and present condition of health of the patient.

In sick patients, all teeth showing periapical lesions should of course be surgically removed, the occasion of their removal to be determined by consultation with the internist. The application of the principles of aseptic surgery in the removal of infected teeth and the eradication of the residual diseased tissue, followed by painstaking care of operative wounds, result in rapid healing with a minimum discomfort to the patient.

In the cleaning up of a diseased

mouth, the extraction of certain teeth showing dento-alveolar or gingivo-pericemental infection plays an important part. It is not the purpose of this paper to give the details with reference to the extraction of the various teeth, but rather to emphasize those principles of treatment which must be adopted to assure complete removal and eradication of all diseased tissue. It is common knowledge that for years dentists with great personal satisfaction would point out to their patients that "the abscess sac has come away with the tooth," and yet in a much greater number of cases they failed to note to their own satisfaction whether similar abscess sacs were left in the alveolar process. The golden rule of minor oral surgery is *look* and *see* what you are doing and *do it well.* This applies to the removal of teeth badly involved by pyorrhea as well as to teeth showing dento-alveolar infection. Much greater attention has been given to the root surface treatment of the latter condition and too little attention has been paid to the large areas of pyogenic membrane left after teeth subject to dental periclasia have been removed. That such areas heal tardily and with considerable discomfort is a well-known fact. Complete excision of the pyogenic tissue is followed by rapid and comfortable healing, practically devoid of local reaction. Depending upon the extent of the involvement, labial or buccal incisions and elevation of the mucosa may be indicated in order to afford free access to the diseased tissue. Removal of a portion of the alveolar process may also facilitate the removal of the tooth and provide better access as in alveolectomy for periapical infection. The infected membrane which necessitates careful and painstaking removal, found in pyorrhea cases, is frequently most adherent. For this purpose, small sharp curettes may be efficient, tho in a larger proportion of cases fine knives or fine-pointed scissors may be necessary to complete the excision. The parts must be kept as dry as possible by sponging in order that visual control of the operation may be maintained. It must not be understood that the entire gingival margins are excised, but rather the lining membrane, so to speak, that had been in contact with the tooth structure is sliced off the overlying alveolar mucous membrane, which is then sutured. The time and trouble taken in carefully removing such infected tissue are well spent and afford prompt healing of the parts with the minimum of postoperative discomfort and practically no danger of systemic complications. Such treatment is rational and conforms to surgical principles.

In operating for the cure of the so-called alveolar abscesses shown by the radiogram as circumscribed or diffuse atrophic areas, the same surgical principles apply. Methods must be adopted, which, in the hands of the individual operator, will assure the complete removal of all infected tissue. Does this mean the routine adoption of the Novitzky operation or the alveolectomy? By no means, for many alveolar sockets will afford good access to small periapical areas. Many, however, do require greater access than afforded by the root sockets, particularly where pathological conditions are extensive. The chief requisites are that the operator must see distinctly what he is doing and that no infected tissue remains in the alveolar process when the curetting is completed. Such a policy, when carried out, will soon develop the individual operator to the point where eradication of disease is the one objective, and the amount of alveolar process removed to gain access thereto will vary with the individual case and the operative skill and judgment of the operator. When sufficient access to the diseased area is obtained, further removal of alveolar process is unnecessary and therefore contraindicated. Prosthetic specialists have objected to extensive alveolectomies from the standpoint of denture restorations,

claiming that ridge resorption is excessive and dentures consequently are less satisfactory. This is still a matter of controversy. We feel that in this matter oral surgeons should be as conservative as possible, consistent with thoro removal of infected tissue. *There can be no compromise with infection.* It would seem to be a matter of individual choice whether to first remove sufficient alveolar process and then extract the tooth (Novitzky) or first extract the tooth and then proceed with the alveolectomy to gain access to the diseased tissue (Shearer). Personally, we feel that resection of the alveolar process first is more logical in that it frequently facilitates the removal of the tooth and prevents injury of the alveolar process overlying adjoining tooth roots. Trauma is in this way minimized.

A third method has been practiced and advocated by men particularly interested in the postoperative condition of the alveolar ridge from the standpoint of denture restorations. By this procedure the tooth is first extracted, following which a buccal or labial exposure is made over the infected periapical area. The approach for the curettage of the diseased tissue is identical to that used in root resection. Curetting may also be carried out thru the tooth socket and observed thru the buccal approach. Complete eradication of diseased tissue may be accomplished by this method. Suturing of the gingival margins, however, is frequently impossible and healing progresses more slowly than when the wounds are closed after alveolectomies.

The Treatment of Infected Dentin

The disease that most commonly attacks the human teeth is dental caries (5, 7, 10, 13). When caries has gained entrance thru the enamel, its progress is generally quite rapid and many times before it is drawn to the attention of the dentist the disease has extended almost to, if not actually into, the pulp. As the result of such conditions there are today many devitalized teeth. It has been common practice under such conditions to destroy the pulp and remove it. This was done because dentists believed that the life of the pulp was endangered, for where they had attempted to preserve the life of this organ pain generally followed.

It is our belief that a tooth affected by dental caries where the lesion extends close to the pulp is seriously involved and is in no condition to recover without treatment. To immediately place in or over it a large metal restoration or filling is an improper dental procedure, regardless of any desire to finish up the case. The history of pulps dying and metastatic sequelae inaugurated is widely accepted (11). The serious nature of the resulting lesion should give us pause in such procedure. All such teeth should be given the proper treatment, and this includes a period of observation before being required to withstand the injury from shock of thermal irritation resulting from large metal fillings.

There are present in the mouth certain conditions and influences detrimental to the tooth pulp and against which it will generally protect itself if vital. In the event of teeth wearing down thru attrition in mastication, it will be found that thru the activity of the odontoblasts (2, 3, 6, 9), a formation known as secondary dentin, which occurs coincidentally with the recession of the pulp, takes place. This is nature's method of maintaining a safe amount of tooth structure between the outside surface of the tooth and the pulp, as a protection from pulp exposure. This is also observed in the instances where dental caries develops slowly.

However, in most instances caries advances rapidly and the pulp is unable to protect itself. It is then that infection approaches very closely and sometimes is in actual contact with pulp tissue. In these cases where there may be no actual perforation of dentin into the pulp by caries and where the pulp is still vital

and hyperemia or pulpitis has not advanced too far, the operation for preserving the pulp vitality consists as follows: In undertaking the operation for the treatment of infected dentin and maintaining the vitality of the tooth pulp, it must be distinctly borne in mind that this operation does *not lend itself to a careless technic.* The same care employed in inserting a gold foil filling must be used. The rubber dam should be placed around the tooth and all overhanging enamel should be broken away. Very cautiously remove the disintegrated dentin by using *sharp* excavators and burs, cutting the softened dentin in such a direction that the instrument is moving *away* from the pulp instead of toward it. *Keep away from the pulp. It is necessary that this work be done under direct vision with the cavity dry and well illuminated.* Many pulps are needlessly exposed because of the fact that the operator cannot see his field of operation. Control any temptation to remove the last layer of discolored dentin which immediately overlies the pulp. Success in this operation seems to be determined very largely by preventing pulp exposure. (The operation here advocated is not a "pulp capping.") It is possible to determine from the radiogram the shape of the pulp chamber. This must be ever kept in mind and the radiogram frequently consulted.

When the disintegrated and softened dentin has been removed but the vital pulp *left unexposed,* a pellet of cotton saturated in a warmed 1 per cent Nuklorene (a form of Dakin's solution) is placed in the cavity and allowed to remain for five to ten minutes. Following this the cavity is dried. (Do not use alcohol and warm air.) For the purpose of sterilizing the layer of dentin overlying the pulp, sterident is used. This consists of a powder, magnesium, zinc and silver nitrate, and a liquid, pimento eugenol. Its method of application is as follows: Mix the powder and liquid to a somewhat thick consistency and place a small portion in the base of the cavity. Gently force this to place with a pellet of cotton or a round burnisher. Be careful to trim it away from the margins.

Following this we apply oxychloride of zinc cement. This is used because it is impervious to moisture. It is mixed to a thick, creamy consistency and placed over the sterident The entire base of the cavity must be covered with the oxychloride of zinc cement (Ames). The balance of the cavity is filled with oxyphosphate cement. (S.S.W. silver cement is used for this purpose). In some instances where it is necessary to maintain contact with adjacent teeth, a thin veneer of alloy is used.

The tooth is kept in this condition for a period varying from six months to a year, depending on the depth and extent of the cavity, when it is generally safe to place a permanent filling therein. During this time it should be radiographed and tested for vitality. It will be found that these teeth remain in a comfortable condition and retain their vitality. Owing to the danger of losing a pulp, no change in any of the materials used is made once they prove satisfactory. For this reason detailed information in this respect has been given. It is not presented as a cure-all for various diseased conditions of the pulp. It is not a pulp capping. The indications for its use must be left to the intelligent judgment of the dentist. It is offered as a solution of the problem which has been so unsatisfactorily solved in the past by devitalizing teeth.

In children's preventive dentistry, while our aim is to prevent cavities developing in the deciduous teeth, yet it will frequently be found that cavities will have developed before the parent brings the child to the office. In these cases the operation is somewhat modified by leaving out the oxychloride of zinc cement.

This operation is presented to the pro-

fession in the profound hope that it will be a material aid in carrying out preventive dentistry by rescuing a large percentage of those perplexing borderline cases. *Maintaining function is* infinitely more satisfactory than *restoring function.*

Correction of Traumatic Occlusion

The relation that exists between traumatic occlusion due to the inharmonious co-ordination of opposing teeth and the condition known as periodontoclasia (once known as pyorrhea alveolaris) has now been widely accepted (12). Consequently, in harmony with our plan for preventing or controlling the introduction of injurious agencies opposed to health, comfort, and efficiency in the mouth, we must minimize the stress (in adult cases) by judiciously grinding the cusps of the teeth that strike too heavily on opposing teeth, thereby preventing injury to the pericementum and associated structures.

Root-canal Operations

In discussing the root-canal operation, it is not the intention to give a description of the operation but rather to give some idea of its place in the practice of dentistry.

No question has ever stirred the profession to the extent that root-canal operations and pulpless teeth have, and at the present time we have very decided opinions that do not entirely agree. However, a survey of current literature certainly gives one the impression that those of so-called radical tendencies have largely modified their views and the number agitating wholesale removal of all teeth which have lost their pulps or are threatened with such a condition has markedly decreased. It would seem that an unbiased opinion of the evidence and opinions submitted would lead us to the conclusion that no sweeping rule can for the present at least be applied to this proposition, but that we should proceed very cautiously taking the minimum of chance and checking up our cases very carefully.

In this connection it might be illuminating to quote Noyes. In referring to the dentinal tubuli after pulp removal, he says: "What is their fate after the removal of the pulp? The thing I want to impress upon you is that we do not know, and we must know about it before the fate of the pulpless tooth is intelligently answered."

As an aid in deciding methods of procedure in cases where pulpless teeth are involved, the following classification is offered: While it is not held as a guide in all cases, yet in our hands it has been found very practical and in the main is a workable guide. We are in accord with the opinion of Grieves (8) relative to the impracticability of determining "well" from "sick" patients. In the first place these terms are relative and we feel safe in leaving the interpretation to the dentist. Obviously, no practical dentist can request every patient to undergo a complete physical examination by an internist before proceeding with his work in the mouth. However, he can ask the patient a few well-directed questions (1), and from the answers to these questions he will know a great deal more regarding the patient's general condition than if such questions were not asked.

Root and Alveolar Surgery

The final operations indicated in removing diseased conditions and establishing oral health are: (1) trimming down the rough margins of partially resorbed alveolar process lying adjacent to the roots of the teeth and known as the pericemental lamella; (2) removal of calculus and smoothing down roughened cementum and enamel. There are many types of instruments to be used in the treatment of dental periclasia. However, one thing should be ever borne in mind, and that is, that in scaling of root surfaces the maximum of efficiency with the minimum of injury to surrounding tissues (including root surfaces) should be the ideal we strive to attain. Frequently it will be found that gingival irritation will not disappear until the enamel sur-

face is made perfectly smooth and highly polished.

When we consider the many and varied etiological factors contributing to a case of dental periclasia, does it not strike you as somewhat funny that the solution of the eradication of this disease many times seems to lie in selecting a set of instruments for planing of root surfaces?

The Oral Prophylaxis Chart

A real tangible step in reaching the goal of preventive medicine is made by the adoption and use of the oral prophylaxis chart. It means that prophylactic dentistry is here and is here to stay. This work is pleasing, inspiring and gratifying. The chart serves as a guide in establishing and maintaining a condition in the human mouth wherein disease will not prevail. The mouths of patients receiving this attention are distinctive in their beauty. This is the definite goal toward which we must strive with our patients.

Pathological Conditions of Pulps and Pulpless Teeth

Classification and Principles of Practice

Conditions Present	Disposition in Adult Cases	
	Well Patients	Sick Patients
(Class I) Pulpless molars and bicuspids with definite periapical atrophy	Extract	Extract
(Class II) Pulpless molars and bicuspids without definite periapical atrophy	Retain and keep under observation, X-ray once a year	Such teeth should be extracted only after consultation with physician in charge
(Class III) Pulpless centrals, laterals and cuspids with definite periapical atrophy	Extract or, if area of atrophy is not too large, resect root end and curette. Keep under observation, X-ray twice a year	Extract
(Class IV) Pulpless centrals, laterals and cuspids without definite periapical atrophy	Retain and keep under observation, X-ray once a year	Extract only after consultation with physician in charge
(Class V) Molars and bicuspids containing non-vital pulps showing periapical atrophy	Extract	Extract
(Class VI) Molars and bicuspids containing non-vital pulps not showing periapical atrophy	Retain, open, cleanse, sterilize and seal canals. Keep under observation, X-ray once a year	Extract
(Class VII) Centrals, laterals and cuspids, containing non-vital pulps, with definite pathology	If area of pathology is not too large, open, cleanse, seal canal. Resect, X-ray twice a year	Extract
(Class VIII) Centrals, laterals and cuspids, containing non-vital pulps, without definite pathology	Save and keep under observation, X-ray once a year	Such teeth should be extracted only after consultation with physician in charge
(Class IX) Removal of vital pulps	Permissible in three classes*	Permissible in Classes 1* and II* but not desirable

	Disposition in Children's Cases	
(Class X) Deciduous teeth containing gangrenous pulps	Extract	Extract
(Class XI) Deciduous teeth with exposed pulps	Make every effort to save pulp; if impossible, extract and retain space.	Make every effort to save pulp; if impossible, extract and retain space.
(Class XII) Permanent teeth with incompletely developed roots containing gangrenous pulps	Extract	Extract
(Class XIII) Permanent teeth with incompletely developed roots and pulps exposed	Make every effort to save pulp; if impossible, extract	Make every effort to save pulp; if impossible, extract
(Class XIV) Permanent teeth with roots completely formed and pulps exposed	See Class IX	See Class IX

*Three classes for the removal of vital pulps: (1) permanent teeth where, as the result of accident or caries, the pulp has been either injured or exposed and cannot be saved; (2) permanent teeth where, pathological changes in the pulp are causing such intense pain that the result will be the loss of the tooth or pulp; (3) vital permanent teeth in which an insufficient amount of the crown of the tooth is left for anchorage purposes.

No tooth on which root-canal work has been done recently should be used as abutments for permanent bridge until they have been kept under observation for at least six months.

There is insufficient evidence at the present time to justify us in removing non-vital teeth, even in sick patients where the pericemental membrane and pericemental lamella are normal radiographically. Our opinion in this respect is in accord with Iron and Noyes (1).

They are seen at one, two or three month intervals, and areas not under perfect control by the patient are drawn to their attention in order that they may concentrate on them, thereby further raising the general tone of the mouth until an almost inconceivable condition of oral health is reached. This, of course, implies that proper restorative operations must be performed.

Presence of food around the teeth.—It is the intention here to record the extent to which food is packed around the teeth. This gives us a good clue to the care the patient gives to the brushing of the teeth. It also is generally to be taken as an indication of the extent to which we may expect dental caries and gingivo-peridental infection.

Calculus.—Here we record the extent to which we see calculus adhering to the teeth. This condition reveals quite plainly the care the patient is giving the mouth, the habits of mastication, and also, in certain instances, is an index to improper diet.

Stain.—There are different types of stain found on the human teeth. The presence of such is recorded. It is an obvious fact that patients will not take pride in their teeth if they are badly stained. In consonance with this thought, patients are carefully instructed in keeping the teeth free from stain by home care. To attempt to keep the teeth free from stain solely by visits to the dentist is futile.

Suppuration.—One frequently encounters mouths in which there is considerable "open infection" (pus draining into the mouth from so-called pyorrhea pockets). Record is made of the extent to which such a condition exists.

Erosion.—Whether of a mechanical or chemical nature, note is made of the ex-

tent to which we find erosion present in the mouth.

All these conditions are recorded, 1, 2, 3, and 4, as previously explained.

New cavities (indicated by the number of cavities).—In order that we may know the progress made in controlling dental caries, record should be made of the development of new cavities, as revealed clinically or by our routine X-ray examination. Also, in order that the conditions influencing the incidence of decay on various surfaces may be recognized, the surfaces on which the decay occurs are noted.

Saliva.—Any information desired relative to the quantity and consistency of the saliva may be recorded. Where special tests are made, the findings are recorded.

This completes the record of conditions of importance found in the mouth. The extent to which pathology is controlled will furnish the index as to the progress we are making in the care of the mouth.

Toothbrushing.—There are so many different ways of brushing the teeth in common use that it must not be assumed that simply because a patient brushes his teeth, it is effective. In doing this work, the patients must understand that they have a definite, specific function to perform and that in maintaining a condition of oral health, success is only possible with their co-operation. By observing the patients brush their teeth in the operating room, the manner and efficiency is easily ascertained and recorded. Areas neglected by the patient are drawn to their attention and further demonstrated by the use of the disclosing solution.

Use of dental floss (record frequency).—Dental floss has an important place in the mouth toilet but injudicious use may injure the teeth or gums.

Dentifrice.—Here is indicated the dentifrice used by the patient.

Mouth wash.—The name of any mouth wash used by the patient is recorded.

Diet.—From a description of the meals of an average day, the amount of sugar, starch, protein, fat and fruit eaten is recorded. The numeral 2 is used to denote what would be considered an average consumption of the various components of the diet, excessive consumption is denoted by 3-4, diminished amount by 1-0.

Beverages.—It is most important that we know and record the average daily fluid intake and what it consists of.

Habits.—Note is made whether or not the patient's daily mode of living is sedentary or active.

Tobacco.—It is of importance to know the extent to which tobacco is used. This is here recorded.

All this information is secured from the patient at the initial examination, and from time to time at the regular appointments progress notes are made of any changes in conditions, habits, etc. In this way control is finally secured of the conditions in the mouth and we can then maintain the much desired healthy oral cavity.

A diagram of the teeth may be used to record the location of fillings, crowns and bridges present when the examination is made, the position of new cavities, or for any special diagrams which may be of interest.

In presenting the material in this paper for consideration, it is with more than a hope, it is with a conviction that it will stimulate a desire to make the practice of dentistry mean more than a series of reparative or restorative problems. In dentistry as in music, there are two types, instrumentalists and vocalists. Do you believe in the *practice* of preventive dentistry, the instrumentalist, or do you derive your pleasure from simply *talking* about it, the vocalist?

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Discussion

Hugh G. Tanzey, Kansas City, Missouri: There are two or three points that I wish to mention, one in regard to extracting teeth. Dr. Best mentions rules whereby you can decide which tooth to extract. The thing I wish to call attention to is the extraction of deciduous molars. A good rule is never to extract deciduous teeth without first consulting the orthodontist. No matter how diseased they appear or what condition exists there, you should first have your written records complete and should then consult an orthodontist. I say this because I do not believe that there is more than 10 per cent of the general practitioners who are trying to save deciduous teeth, and I think not more than 10 per cent of the deciduous teeth that are being extracted should be extracted. My observation has extended over a period of twenty to twenty-five years and I have observed these teeth not only in my general practice but at different times before and after extracting in the last ten years, and there is a great amount of damage from the premature extraction or premature loss of deciduous teeth. Of course, that holds good with the permanent teeth too.

S. J. Z. Gantz, Minneapolis, Minnesota: The statement was made that a deciduous tooth should never be removed until an orthodontist is consulted, no matter what condition the tooth appears to be in. In my opinion it is sufficient that we all know, or should know, that a deciduous tooth should not be prematurely removed unless irreparably infected, and for that reason a menace to the health of the patient. Could it possibly make any difference in our treatment if the orthodontist was to tell us that the removal of an infected tooth under consideration may result in lack of development of that jaw and malocclusion of the teeth, if the infection of that tooth could not be controlled? It is my belief that if any consulting is to be indulged in, the orthodontist should never retain an infected tooth until he has consulted the periodontist. The periodontist, on the contrary, having had the opportunity to see the very grave results of infected teeth, may be inclined to extract more often than he should; so that consultation cannot help but be of benefit. However, I would rather be the man who has extracted a few teeth too many than one too few, for after all the possibility of malocclusion is not so important when compared with the possibility of a crippled heart valve.

Julian Smith, Dallas, Texas: I wish to commend and emphasize the essayist's method and technic of treatments in preserving the pulp, alive and healthy in the tooth, when exposed or almost so. To the periodontist the saving of pulps is of greatest importance. We all dislike pulpless teeth and know the things we have to fight in regard to them, and I wish to commend the essayist for the stand he takes as to extraction of pulpless teeth. Too radical measures are being used by the exodontists and dentists in general practice, in the loss of such teeth.

Dr. Best (closing): Our attention was drawn to a most important point in the advantage of consultation between the dentist in charge of children's work and the orthodontist. It was not meant to be conveyed that the orthodontist should in any way dictate the policy of the periodontist in deciding whether a given tooth for a young child should be retained or removed, and if removed, how the child's interests can be best protected. This should surely be taken seriously and should be a matter for consultation. We should seldom if ever make any compromise with infection.

I do not need to more than mention the difficulties you encounter in doing work for children. It is very difficult for patients to appreciate the fact that the services rendered

children are as important as those rendered adults, because people cannot help thinking of the temporary work and the small fee. If a dentist cannot get as large an income from taking care of the children as from taking care of adults, he will not do work for children. Unless you have certain arrangements with parents you cannot get the same income from working for children that you can from working for adults. In this work it is 75 per cent preventive and 25 per cent restorative. The dental hygienist can do most of the work with the children. We should educate the medical men so when they go into the homes they will tell the parents that the children must be sent to the dentist if they wish to escape trouble. The child is taken to the dental hygienist and she keeps the mouth clean. There is certain work that the dentist will have to do for those little patients occasionally, but not much. It has been found that dental caries occurs on the occlusal surface of molars in over 50 per cent of the cases. I have about completed experimental work for an operation or method of treatment which will, I feel confident, prevent most of the occlusal decay. When we can so treat these molars that they will no longer decay, we will have taken a big step. Above all other things, you must give these children a chance. Many of the adults whose teeth were neglected during childhood have to make the best of their masticatory apparatus. You cannot do the good by fillings that you can by prevention, and the routine polishing can be done by the dental hygienist, and the work can be done at such a moderate fee that it will not be a hardship. This, together with substituting fruit for candy and pastry and checking up on the diet problem will in most cases almost solve the problem of decay in children's teeth.

As regards pyorrhea being due to the disturbance of the balanced diet, and whether it resembles scurvy, in some forms of so-called pyorrhea, I do not think diet has anything to do with it. As for a balanced diet, I have found that there is a great difference of opinion as to what this should consist of. Certain things in certain patients seem to be just about what that patient needs, and in other cases it is something quite different. We are trying to keep a record of the kind of food eaten by the different patients and also keep a careful record of the condition in the mouth, so we may find later what keeps up the healthy condition in the mouth, and if it does not remain healthy, we may learn of the relation that may exist between diet and mouth conditions from the standpoint of the clinician.

Another thing we record are the habits of mastication, and it is interesting to note the relation that exists between the way people eat and gastro-intestinal conditions.

We are confronted with a large problem and we must solve it. The welfare of little children and adults alike demands that we recognize and act on this idea, *prevention is better than restoration.*

ACTION OF HYPOTONIC, ISOTONIC AND HYPERTONIC SOLUTIONS UPON THE BLOOD, MUSCLE AND NERVE TISSUE CELLS OF LIVING ANIMALS

By IRA G. NICHOLS, D.D.S., Mandan, North Dakota

(Read before the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

THE earliest method of any service, to alleviate pain, was probably compression of the nerve trunks, practiced by the Arabs, revived by Paré in the seventeenth century.

The freezing process acts as a terminal anesthetic and applied to peripheral nerve endings will completely block their conduction. But this is accomplished only at the expense of the danger of sloughing. Electricity came in for its trial (3) as a local anesthetic, and as a means of carrying in drugs was at one time extensively employed. Local anesthesia, thru the physiological action of special drugs, was made possible in 1853, by Alexander Wood, who introduced the hypodermic syringe, thus offering a new means of applying solution to the sensitive parts. Wood began work at once, with the injection of morphine in the neighborhood of nerve trunks for the relief of neuralgia. It was soon proved that the relief of pain was not caused by any local effect but was due to a general hypnotic action.

Many other substances were tried, but none were found satisfactory until cocaine was introduced in 1884, by Kollar. The addition of adrenalin to the local anesthetic solution following its isolation from the suprarenal gland by Takamine and Abel was a wonderful step forward in perfecting the local anesthetic solution. It was found by investigators that the injection of a solution of sterile distilled water containing cocaine and adrenalin produced post-operative pain because it was not isotonic.

Chemically, a local anesthetic vehicle of the same specific gravity and the same freezing-point as the tissue fluids, when injected slowly, does not cause pain. An isotonic fresh Ringer solution is an example. The vehicle possessing a greater or less osmotic tension when injected into the delicate tissues causes a break in the osmotic balance which produces changes in the tissue cells.

By the use of an isotonic fresh Ringer solution as a vehicle for the local anesthetic drugs, the tissues are not injured. The three chlorides, sodium, calcium, and potassium, make a true physiological solution and have their specific functions; therefore it is evident that Ringer's solution makes an ideal vehicle for the local anesthetic and vascoconstricting agent. A saline solution contains only sodium chloride, whereas Ringer's solution contains, in addition to sodium chloride, calcium and potassium, which make a true physiological saline solution.

THE BLOOD—GENERAL CONSIDERATIONS

"The blood is an important fluid of the body, as it bears a more or less defi-

nite and direct relation to all other body fluids and tissues. It is the intermediate substance between the nutritive materials taken into the body thru the digestive tract and elaborated into pabulum by it, and body cells, to which it gives nutriment and from which it carries away effete and waste materials.

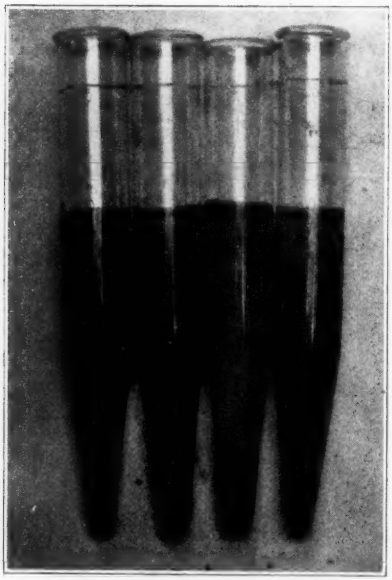


Fig. 1.—Experiments with hypotonic, isotonic and hypertonic solutions. In each test tube was placed three mils of blood. To tube 1 (reading from left to right), seven mils of sterile distilled water (hypotonic) were added which quickly destroyed (hemolysis) the red blood corpuscles. To tube 2, seven mils of an isotonic solution were added which caused the red blood corpuscles to deposit in the bottom of the tube; microscopic examination shows cells to be normal. To tube 3 seven mils of a hypertonic (1.70 per cent) solution were added which caused a rapid contraction and crenation of the red blood corpuscles. To tube 4, four mils of a hypertonic solution (2.55 per cent) were added which caused a rapid and greater destruction by crenation of the red cells than the 1.70 per cent solution in tube 3. Ringer constituents were employed in Tubes 2, 3, 4. The hypertonic solutions were obtained by boiling the Ringer vehicle. All four of the tubes were prepared and centrifuged at the same time.

"We must, therefore, have a working knowledge of the normal physiology and histology of the blood in order to comprehend departures from the normal and to appreciate their pathologic significance."

Physical and Chemical Properties

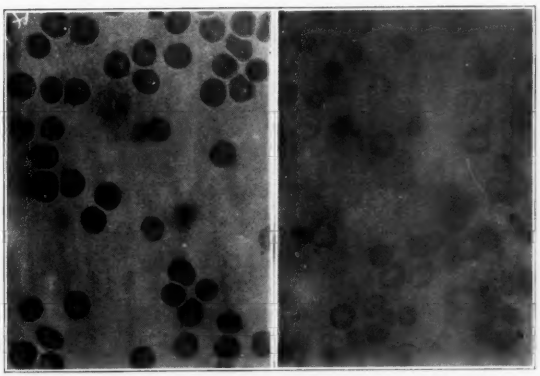
Appearance of fresh blood.—The exuding drop of blood shows a number of properties even to the naked eye (1). The redder it is, the richer it is in oxyhemoglobin; the darker, the greater the amount of reduced hemoglobin. Microscopically, it reveals a great number of cellular elements; these are colored and colorless disks.

The red cells appear as non-nucleated biconcave disks, measuring on the average 7 microns in diameter. Viewed singly thru the microscope by transmitted light, they are of pale yellowish hue. The colorless cells or white corpuscles are, as a rule, somewhat larger than the red cells, and present either mono- or polynucleated protoplasm.

Color.—The color of normal blood is due to the presence of an albuminous substance in the corpuscles termed hemoglobin. (2). In the arterial blood it is in combination with oxygen, and is here termed oxyhemoglobin. In the venous blood a mixture of both hemoglobin and oxyhemoglobin occurs. With a preponderance of oxyhemoglobin, the blood tends to a scarlet hue; when the hemoglobin predominates, the blood is of a bluish color.

The Chemical Composition of the Blood

A general idea of the composition of the blood may be had from the table (p. 149) which is taken from Simon's *Physiologic Chemistry*. The calculations are made for a thousand parts by weight.



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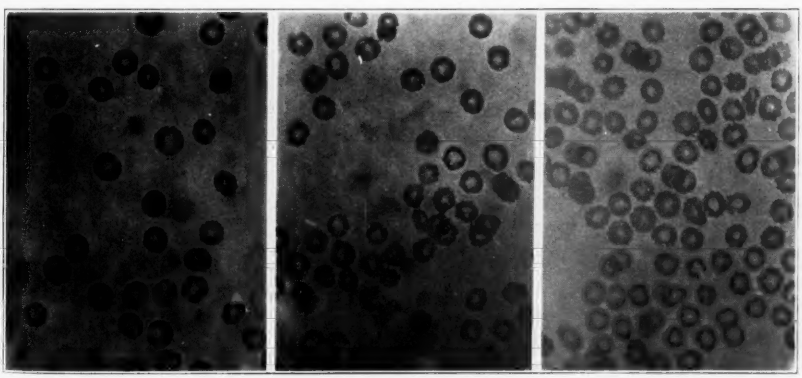
Figs. 2, 3.—Microscopic views (×950): Fig. 2, normal red blood corpuscles which have been placed in an isotonic Ringer vehicle. The cells are normal in size and their rounded edges are distinctly shown. No change has taken place because they are contained in a Ringer vehicle which is physiologically isotonic. A local anesthetic solution should possess this important factor. One white blood corpuscle is seen to the left of the center of the field. Fig. 3, red blood corpuscles which were placed in a hypotonic (distilled water) vehicle. The cells are anemic and swollen due to absorption of water. Some of the cell membranes have become ruptured due to absorption and distension.



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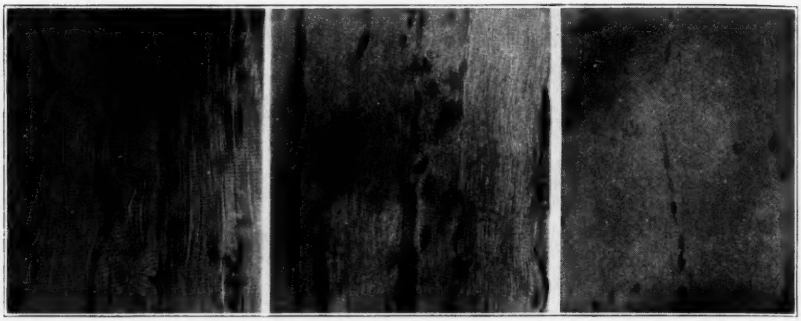
Figs. 4-6.—Microscopic views (×950): Fig. 4, red blood corpuscles which were placed in a solution that was allowed to boil only a few seconds, causing enough vapor to pass off to make a slight hypertonic solution. Note that the cells show crenation. Fig. 5, red blood corpuscles which were placed in an isotonic Ringer solution but at a temperature of a 130° F., which caused a great destruction to the red blood corpuscles, because heat was above body temperature. Fig. 6, destruction of red blood corpuscles which were placed in a hypertonic solution, prepared by boiling a stock Ringer solution four minutes. Every cell in the field clearly shows an irregular outline, contraction and crenation caused by the cell content being absorbed by the hypertonic vehicle to which they were subjected. This process is known as crenation.



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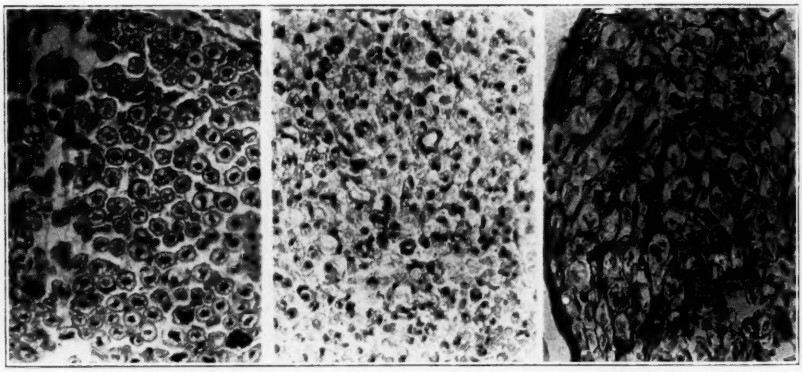
Figs. 7-9.—Microscopic views (×500) of longitudinal sections of voluntary muscle of a rabbit. In Fig. 7, it is normal. The various muscle stria and nuclei are clearly shown. Fig. 8 shows section removed twenty-four hours after the injection of a hypotonic (sterile distilled water) solution. The muscle fibers and cells are greatly distended and swollen, the tissue is edematous due to the excessive absorption. Fig. 9 was taken from the same region as specimen shown in Fig. 7 after being injected with a hypertonic (1.8 per cent) solution. This section was removed twenty-four hours after injecting the hypertonic solution into the muscle. The muscle fibers and cells are contracted and a cloudy condition of the tissue is clearly shown, which is due to the action of the hypertonic solution. The stria have lost their identity.



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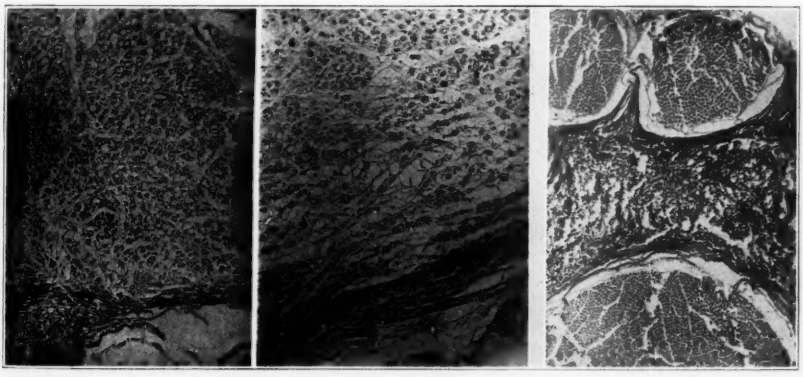
Figs. 10-12.—Microscopical views (×450) of cross-section of nerve tissue from the sciatic nerve of cat: Fig. 10 shows normal tissue which was treated with the Cajah method in order to bring out the axis cylinder. Fig. 11 shows section taken from the same region as section shown in Fig. 10 ten days after the nerve was injected with a hypertonic (1.2 per cent) solution, which was prepared by boiling a stock Ringer solution. This section shows proliferation of syncytial cells of sheath of Schwan and increased intraneural connective tissue. Fig. 12 shows section taken from the same region as section shown in Fig. 10 ten days after the nerve was injected with a hypotonic (0.7 per cent) solution. Swollen myelin.

	Parts
Corpuscles	480.00
Water	276.90
Oxyhemoglobin	193.90
Stroma, including salts	9.20
Plasma	520.00
Water	477.37
Albumins	35.88
Extractives	2.39
Inorganic salts	4.36

The predominating solid substance in the blood is oxyhemoglobin; it represents 10 per cent of the total weight of the blood, 40 per cent of the weight of the corpuscles, and 65 per cent of all organic matter present. The mineral constituents comprise sodium, potassium, calcium, magnesium, and iron.

Osmotic Properties of the Blood

The red cells will be found to dissolve promptly when a drop of blood is placed in distilled water, but when placed in an isotonic Ringer solution the red cells retain their normal size; i.e., when two solutions of different concentrations are separated by an animal membrane, these solutions pass thru the membrane until they are of equal densities, or the quantity of salts in each is equal. The force producing this interchange is termed "osmotic tension," and the two liquids containing an equal quantity of the salts are termed "isotonic." Fluids containing a greater or lesser quantity of diffusable salts are termed "hypertonic" or "hypotonic," and possess the faculty of absorbing or giving up water, in accordance



13 14 15

Figs. 13-15.—Microscopic views of cross-section showing sciatic nerve of cat. Fig. 13 (×110) shows section taken from nerve at point of injection thirty days following the injection of two mils (c.c.) of a sterile distilled water solution. No change in nerve tissue. Tissue returns to normal. (See Fig. 12 for change that takes place ten days following an injection of hypotonic solution.) Fig. 14 (×110) shows nerve sectioned thirty days following the injection of one-fourth mil (c.c.) of a sterile isotonic anesthetic solution, which consisted of 2 per cent procaine, 1/250 per cent suprarenin and Ringer constituents. No change in tissue cells occurred. Fig. 15 (×80) shows section prepared thirty days following the injection. Two mils of Ringer solution were boiled for four minutes, which reduced the volume to 1.3 c.c. giving a hypertonic concentration of 3.85 times isotonicity. One mil (c.c.) was injected. The section shows round cell infiltration of the perineural connective tissue causing a permanent lesion, which may remain stationary and no further degenerative changes take place but may be only the beginning of certain conditions which may prove dangerous to the patient's general health and welfare.

with the law of osmosis. Ringer's solution prevents either swelling or shrinking of the blood and tissue cells.

Isotonic Solution

An isotonic anesthetic vehicle must be composed of such chemical constituents in their proper proportions as found in the blood, muscle, and nerve tissue cells in order to correspond to the physiological laws and functions of the living cells.

Hypotonic Solution

A solution that is lacking in the proper amount of the sodium, calcium, and potassium chlorides, due to an excess amount of water or of water alone is a hypotonic solution. A hypotonic solution will cause the cells to absorb the water until there is an equalization which causes the blood and tissue cells to become distended.

Hypertonic Solution

A solution that contains more salts than the blood and tissue cells is a hypertonic solution. A hypertonic solution will cause the cells to give up the water, producing crenation of the blood cells and shrinking of the muscle and nerve tissue cells. This is one of the greatest causes of postoperative pain.

There are many who overlook the exact technic for the preparation of the local anesthetic solution. The anesthetic solution must be composed of ingredients corresponding to the physiological laws and functions of the living cells.

The experiments were made in the Department of Experimental Surgery, University of Minnesota, by J. F. Corbett, Arthur E. Smith and myself.

Summary

The experiments show that the tissue cells return to normal within thirty days after an injection of a hypotonic solution. There is no change in the tissue cells from an injection of an isotonic anesthetic solution, but there is a permanent injury to the tissue cells from the use of a hypertonic solution, which may remain stationary and no further degenerative changes take place; however it may be only the beginning of certain conditions which may prove dangerous to the patient's general health and welfare.

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2. Gwathmey, *Anesthesia*, p. 477.
3. *Ibid*, p. 46.

A CLASSIFICATION OF ORAL MANIFESTATIONS OF SYSTEMIC DISEASES ACCORDING TO TYPE

By HARRY BLOCH, B.S., D.D.S., St. Louis, Missouri

(Read before the National Dental Association, Milwaukee, Wisconsin, August 15-19, 1921)

IN CLASSIFYING oral diseases which reflect systemic disturbances in the form of structural alterations and functional impairment, it is well to begin with the specific infections that might very correctly be classified under the general terms of the angina type.

It should be borne in mind, however, that the term "angina" is merely a descriptive and qualifying term which can be only correctly employed to describe a sequential train of morbid anatomical lesions and as such it may be applied to any pathology having as a characteristic complicating feature a sensation of strangling, suffocation or spasmodic choking. The phenomenon is to be often observed as an accompanying symptom of numerous acute and chronic infections, neoplastic formations, etc., involving the mouth, throat, the intrathoracic and often the upper intra-abdominal viscera.

The disease of stomatitis with or without throat complications and consequent anginal manifestations was recognized and described hundreds of years ago, but specific ulcero-membraneous stomatitis better and more familiarly known as Vincent's angina is of comparatively recent origin, having been first accurately described and named by Vincent in 1896, altho the bacillus was first isolated by Plaut in 1895. Vincent first observed the spirochete in cases of nosocomial gangrene accompanying bed sores and later isolated the organism from mouth infections. The disease owes its origin beyond any doubt to the symbiotic action of the fusiform bacillus and the spirochete. This condition is essentially a contagious or infectious disorder and may attack any portion of the bronchial, laryngeal, pharyngeal, tonsillar, palatine, lingual, gingival or buccal mucosa.

We may have also a syphilitic angina, which may appear as a reddened, edematous and swollen mucous membrane of the isthmus of the fauces, soft palate, and uvula. A number of soft gray glistening bow-formed or round mucous patches may likewise be observed. Often the mucous patches tend to coalesce, forming a network.

Mercurial angina is not at all infrequent and is characterized by an intense edematous red and swollen condition of the epithelium and the underlying structures. The soft palate and the uvula may or may not present a yellowish white pseudo-membrane which may be often confused with diphtheria. The gums may or may not present ulceration and a pseudo-membrane. If diphtheria be suspected the Klebs-Loeffler bacillus should be sought for.

One may occasionally observe such a condition as angina follicularis catarrhalis wherein an acute inflammation of the fauces is seen accompanied by marked fever. There is much congestion and inflammation, causing a narrowing of the fauces. One or more of the tonsils may be involved. From the lacunae of the tonsils, projecting and raised yellowish white bodies often occur. These contain pus cells and an abundance of dissolved peptonized tissue.

Diphtheritic angina is characterized

by an active inflammation. The tonsils may or may not be affected. In the case under discussion, a grayish white markedly adherent membrane was observed on the left anterior and posterior pillars of the fauces, left tonsil, left half of the soft palate, the uvula, and extended as far as the posterior wall of the pharynx. There was not much coating of the tongue. In this case the constitutional symptoms were not very marked. No high fever was observed. It should be remembered, however, that when the Klebs-Loeffler bacillus is found in combination with other organisms, as these cases most often do in a mixed infection, a very marked and destructive endotoxin is produced and when absorbed will very often lead to fatal termination.

Mycotic angina: In this case the follicles of the tonsils were not very much enlarged. Yellowish-white keratogenous plugs were observed and were found to be raised a few millimeters above the mucous membrane. The plugs were microscopically composed of threads of fungi (Leptothrix buccalis), epithelium and calcareous matter.

Catamenial type: The vascular excitement attending the menstrual flow cannot fail to influence the entire system. The nervous system is especially affected. Like dentition, pregnancy in a healthy person is a physiological process but very often one of excessive activity and borders on the abnormal in many cases. The morning sickness often results in excessive vomiting producing a marked acid reaction to the saliva. With this excessive physiological activity the close relationship between the nervous mechanism and the generative organs may be observed in many ways. Marked hyperemia is common, also gingival atrophy and osseous absorption. It is not at all uncommon to find fillings which have been inserted many years prior to this condition completely exfoliated. Hypersensitiveness of the tooth structures is very prevalent. The deranged nervous system which often accompanies pregnancy to a more or less degree may so affect digestion and assimilation that the blood becomes impoverished and the teeth therefore are not properly nourished. This will produce a greater susceptibility on the part of the teeth to the acid-producing organisms in the mouth and caries will result.

Constipation is characterized by an accumulation of effete material in the system not only in the intestines but in the blood as well. Marked congestion locally with fetid breath and symptoms of interstitial gingivitis are not uncommon. An endarteritis obliterans of the blood vessels of the peridental membrane and pulp is common. Hypertrophy and hyperemia are very characteristic symptoms.

Scurvy: The tongue is heavily coated and the breath fetid. The gums are markedly inflamed, hypertrophic and loosened from their attachments. Ulcers will often appear upon the mucous membranes and the teeth will sometimes be exfoliated. There is a tendency to hemophilia when the gums are brushed or slightly palpated, in addition to their being painful.

Rachitis: The symptoms are most characteristic as the child develops, altho the disease may be congenital. Imperfect calcification of the bones results in certain deformities which become very apparent. Retarded dentition and irregularity of the teeth are to be noted as a marked characteristic of rachitic children. The tooth form is irregular and diminutive in size. As a result caries is very common among these children.

Exanthema and scarlatina: Characterized by inflamed red and edamatous mucous membranes of the pharynx, tonsils and velum and a very characteristic red rash on the hard palate. The tongue will often appear strawberry-like in color, because of the general aspect of the dark red papillae.

Variola and varicella: Eruptions appear on the palate in the form of vesicles which soon rupture and leave rather

shallow ulcers. The mucous membrane around these areas is congested and hyperemic. Beneath the ulcers the mucous membrane appears light red and bleeds rather freely.

Measles: White pin-point vesicles known as Koplik's spots appear on the buccal mucous membrane in the region around the molars. As the disease progresses the vesicles tend to coalesce and leave a red area. They may often ulcerate with the resultant condition of coagulation necrosis.

Diabetic type: One of the characteristic bacteriological findings is the abundance of sporulating bacilli that might be isolated from the oral cavity. The saliva is acid in reaction and the so-called acetone breath in severe cases very marked. The diabetic shows very little resistance apparently to infection, and the healing processes are slow. This holds true for the mucous membranes as well as other parts of the body, and might be due to retrogressive tissue changes caused by hyperglykemia or by disturbances of the ductless glands. The epithelium of the mouth appears unusually red and the patient will complain of the mouth feeling dry and hot due to the fact that such an abundance of sugar is expelled by the kidneys that it requires a large amount of liquids to carry it off. Diabetics often find it difficult to wear dentures as the pain resulting from pressure seems very annoying. Then again the tongue seems rather large in size. The papillae are enlarged and sometimes discolored. They appear bluish red. Postoperative complications following extraction are very common. Ulceration and necrosis of the epithelial and osseous structures are not at all infrequent. Marked detachment and recession of the gums may be noted, exposing at the same time more or less sensitive comentum. Luxation and exfoliation of the teeth may occasionally be observed.

Tubercular type: Tuberculosis of the mouth may appear in very many forms. Insignificant isolated spots or severe extensive processes which develop from the characteristic initial tubercular lesion may be noted. In the oral cavity we may have a single tubercle or a number of them may appear at the same time. Very often a differential diagnosis must be made between lupus and other tubercular processes of the skin and the mucous membranes of the mouth. The lupus nodules occurring on the mucous membranes are not so characteristic as upon the skin. They are not similar in color or consistency and there is no desquamation or hyperkeratosis. The nodules in the mouth ulcerate more rapidly. The first tubercles give no manifestations of their presence, and their appearance may be entirely unnoticed. The mildest form of tuberculosis of the mouth is the ulcerated miliary tubercle or the tubercle granule. Each ulcer tends to develop in a tubercular infiltrate which produces such little disturbance that the individual may be totally unaware of its presence; it is recognized only when the disintegration and formation of the ulcer starts. These small ulcers originate from the miliary tubercle. The tubercular ulcer is characterized by its irregularity and its undermined edges and a very fine granular uneven floor which is covered with yellow or greenish-yellow pus. The form of the ulcers appears differently, depending upon their location and the structures of the tissue beneath them. Upon the mucous membrane of the lips and cheeks they often appear oval or round and extend superficially. Upon the soft palate the ulcers penetrate deeply into the tissues, and those upon the tongue are long and indented, and somewhat cleft-like. There is a red wall around the ulcers which is somewhat raised. Primary tubercles and ulcerations grow slowly but steadily and if treatment is not proper or timely a diffuse tubercular inflammation may ensue. The tubercular process may, then, extend either superficially or deeply, or in both manners. However, tubercular tissue

may not always undergo disintegration and instead we may have a more or less extensive tubercular infiltration of the mucous membrane with small or large ulcers. Upon the palate the mucous membrane acquires a bluish-red color, and much congestion, inflammation and edema are observed in connection with the fauces and uvula. Ulcers often arise from the confluence of a large number of miliary tubercles which may be covered with yellowish-white pus. It is rather difficult to find the tubercular bacillus in tubercular lesions of the mouth.

Rheumatic and gouty types: Many of us have observed the type of mouth that reflects the uric acid diathesis. It might be the result of incomplete oxidation by virtue of which the precursors of uric acid and other similar bodies are not completely oxidized. Pathological conditions result from an accumulation and toxicity. The circulation of the epithelium of the gums, of the pulp tissue and of the peridental membrane are interfered with. Hyperemia and an endarteritis obliterans are not uncommon. Erosion cavities, fan-shaped appearances of the upper central and of the lateral incisors, and a marked separation between the teeth, also atrophy, give us a distinct clinical picture. There is also marked abrasion of the occlusal and incisal surfaces as well as a marked acid reaction of the saliva.

Syphilitic type: Fournier states that of 1,124 extra genital primary lesions, 849 were upon the head. Of these, 567 were on the lip, 75 on the tongue, 69 on the tonsils, 11 on the gums, and 1 on the mucous membrane of the cheek. Extra genital chancres constitute about 8 per cent of the entire number of primary syphilitic lesions. It should be remembered that in order to contract this disease the port of entrance for the *Treponema pallidum* must come in contact with the exudate of a chancre or a mucous patch, or with some substance within which the *Treponema pallidum* is found. In addition to this the disease may be contracted by coitus per os, cunnilingus, etc. Syphilis may be acquired by kissing for the organism seems to possess a predilection for the mucous membrane of the mouth and this is especially marked during the secondary period. The lesions may be entirely unnoticed, yet they are highly infectious, as the *Treponema pallidum* is observed in them and then pass into the saliva in large numbers. For this reason the dental surgeon should be constantly alert to the early recognition of the disease and the safeguarding likewise of his own health. Nursing may also be a mode of transmission. On the gums, cheeks, and palate the chancre is not often seen, but it appears more frequently upon the tonsil.

Heretofore the prognosis of the extra genital chancre had not been looked upon as being very favorable. In general this is not altogether correct. In many cases the extra genital manifestations are often overlooked, and early treatment is therefore omitted, which in turn favors the development of later and more serious lesions. Primary lesions upon the head, it has been claimed altho not proved, afford an easy means of transmission of the treponemata entering the brain in large numbers and thus resulting in very serious cerebral disturbances and complications. Chancre of the lip occurs at first as a flat erosion, not shining and not elevated very much and somewhat hard and cartilaginous. It may have a thin covering and on pressure an exudite of clear yellow serum containing numerous treponemata may be expelled. This small erosion gradually increases in size while the induration is superficial. No pain is felt by the patient and there is no inconvenience. Chancres may be either of the erosive type or of a papular, elevated, or hypertrophied type. It will then resemble a tumor covered with a fibrinous membrane or crusts. Upon the lip the chancre may undergo suppuration resulting in an ulcerated lesion. The ulcer is often surrounded by deep indurated tissue, and a mixed infection is in-

variably the etiology of the ulcerated chancre. The neighboring lymph nodes or ganglia are most usually involved so that an adenopathy of the submaxillary and submental lymph ganglia follows. A unilateral enlargement of several ganglia occurs which is determined by that side of the lip upon which the chancre is located. The nodes are movable and painless and may suppurate. Upon the lips the primary lesion seems to have a predilection for the center of the vermilion border where injuries to the epithelium are most apt to occur. Upon the tongue as on the lip it may appear as an erosion as a papule, or in an ulcerated form.

From four to six weeks after the primary lesion, the secondary symptoms of syphilis occur. By this time the treponemata have traveled the entire organism by means of the blood and lymph and a general systemic infection occurs. The infection at this time affects all organs, even the viscera and the nervous system, but especially the skin and dermopapillary mucous membrane, including the lips, mouth, tongue, pharynx, larynx, nose, and eyelids. Upon the mucous membranes we have the characteristic mucous syphilides, these are commonly called mucous patches. The mucous syphilides are moist and great numbers of treponemata may be obtained. The cutaneous syphilides are dry lesions. Mucous patches may be observed upon the skin, where they may become eroded and are known as condylomata lata. The mouth symptoms give little evidence of their presence but are very highly infectious. Erythematous spots may also appear upon the mucous membrane of the oral cavity characterized by a hyperemia. Their appearance is usually synchronous with that of other manifestations of secondary syphilis, and they react to antisyphilitic treatment. The most common type of lesion of syphilis of the mouth is the erosive syphilide which is a superficial erosion about 2 cm. in diameter. If an inflammatory reaction takes place in this lesion it becomes denser and is raised above the surrounding mucous membrane, becoming the typical mucous patch. This form of lesion may appear whitish, yellow, or bluish, and sometimes like an opal, or it may become raised or hypertrophied and its surface gray, murky yellow or white. The mucous patch may also undergo ulceration surrounded by a very extensive inflammatory zone. Diffuse and chronic interstitial glossitis may be observed. The papillae are often raised and sometimes appear as smooth reddish spots. Syphilitic angina is frequent. The tonsils may not always be involved. The lesion in the form of plugs may be localized upon the faucial pillars which distinguishes the syphilitic from the follicular angina. *The oral lesions of tertiary syphilis* are frequent, but do not possess such a predeliction for the oral mucous membrane as the secondary symptoms. The lips, tongue, hard and soft palate, tonsils and the bones forming the mouth are susceptible. Papules and nodules are common. These in turn may form reticulated ulcers. The nodules may not undergo necrobiosis, but become sclerosed and form what is known as tertiary papular syphilides. However, the greater number of tertiary syphilitic lesions of the mouth begin in the submucous tissue, leading to the formation of gummata, which in turn undergo more or less rapid progress and necrobiosis. The gummata may undergo coagulation necrosis and form large ulcers. The lesions of this stage often have their origin in the bone or the periosteum of the mandible, hard palate, and the bones of the nose may be involved. Loss of the periosteum leads to necrosis and various pieces of necrotic bone may be discharged before the patient is aware of his condition.

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THE CAST INLAY RESTORATION

By GEORGE M. HOLLENBACK, D.D.S., Los Angeles, California

(Read before the National Dental Association, Milwaukee, Wisconsin, August 15-19, 1921)

OF ALL the many methods and processes which have been discovered and developed, relative to dentistry, there is none in my opinion that has been of so great a benefit and so far-reaching in its effects as that of the cast inlay restoration. The understanding and utilization of this wonderful process has in fact so revolutionized dental procedure, both in the operative and prosthetic fields, that its advent marks the beginning of one of the great epochs of dental history.

Coming as it did in the year 1907, just a few years before the condemnation of methods theretofore used by Dr. Hunter (whose statements were later proved to be true by the findings of the radiograph and by bacteriological and pathologic studies) its advent was most opportune. By its use we have been enabled to change our course of procedure in these lines of work so that we are no longer in a position whereby we can justly be subjected to such criticism. I do not mean that our endeavors are entirely above criticism, but that they cannot justly be subjected to such wholesale condemnation. This radical change was brought about by the acceptance by a majority of the thinking men of the profession of the criticisms of Hunter, and also the acceptance by them of radiographic findings relative to their work. The dental profession being always progressive and on the alert to correct the mistakes of the past faced this problem squarely and proceeded to evolve new methods which would be in accordance with this newly gained knowledge. These methods were rendered feasible and practical by the casting process. If we did not have this process we would be in a very serious predicament; in fact it would be almost impossible for us from an economic standpoint to make many of our restorations in an acceptable manner. Of such great worth is this process to humanity that its inventor, William H. Taggart, should be classed as one of the great benefactors of mankind.

In relative value the cast restoration will take its place as one of the two best at our command, these two being the gold foil filling and the cast inlay. The former, when properly made and when placed where it is indicated, has proved to be the most satisfactory and the most long-lived restoration. However, the inlay has the greatest value to the profession because it can be much more universally used. In the consideration of restorations, it might be well to digress a moment to consider the fundamental requisites for a filling material. (1) It should be an adaptable material by the use of which the restoration will restore the lost parts to complete functional contour, that is, reproduce the anatomy to the finest detail. (2) It must hermetically seal the cavity. (3) It must be of a constant form and free from shrinkage and expansion. (4) It must not deteriorate, corrode, or disintegrate in the mouth. (5) It must be hard and resistant to withstand occlusal and interproximal wear. (6) It should be aesthetic in appearance. (7) It must be of such

a nature that it can be successfully placed in locations difficult of access. (8) It must be free from porosity, that is, nonabsorbent, for an absorbent material will become saturated with bacterial products and putrefactive matter, thus causing infection of the dentin and pulp. (9) It should, to a certain extent at least, be a nonconductor of heat. (10) It must by a combination of these properties be capable of a long and satisfactory service. Gold foil we know will meet these requirements. The inlay probably will too, if properly made, but its case has not as yet been so well proved. The plastics, with the exception of amalgam, most emphatically will not. Even with amalgam long service is an exception and not the rule.

One of the plastics which absolutely fails to meet any of these requirements but that of aesthetics and ease of insertion has come into extensive use. This material is the silicate cement or so called synthetic porcelain. Its use is not to be considered in really high-class practice. Unless it is greatly improved it should be eliminated. These statements can be amply verified by any operator who will carefully study conditions and observe the serious effects and amount of pathology which its use entails. From the foregoing statements, we are amply justified in assuming that of the several methods and materials at hand the gold foil filling and the cast inlay restoration are by far the best. Each has its place and neither should be used to the exclusion of the other. As a general rule, the inlay is best suited for large, complicated restorations in the posterior teeth, and foil for the smaller restorations in the posteriors and for the great majority of anterior restorations.

In considering the cast restoration, or rather the technic involved in its construction, we will find the process divided into several distinct steps as follows: (1) cavity preparation; (2) making of the wax pattern; (3) investing; (4) elimination of the wax; (5) casting; (6) finishing and cementation of the inlay. It will not be amiss to accentuate the fact that no one of these steps is more important than the other. The success of the operation demands that each one receive equal consideration and care, for the slightest negligence anywhere will result in a more or less imperfect product.

The intention of this paper is to describe a certain technic which has been used by myself and many others over a period of years, and whose results, while not perfect, are quite satisfactory. A careful study of the work done by different operators will disclose the fact, that many of them are getting equally good results by technics which, in many respects, are very dissimilar. The only claim made for this technic is that it is simple, logical, and is easily followed, and as before stated is capable of giving satisfactory results when *carefully* followed. In describing this technic each step will be taken up in the order given.

Cavity Preparation

In so brief a paper it will be impossible to describe the preparation of all classes of cavities. An attempt will be made to briefly describe the principles involved in the preparation of a mesio-occlusal cavity in a posterior tooth. If these principles are well understood, it will be comparatively easy for the operator to vary them to conform to the different conditions with which he will have to contend.

The mechanical principles involved in cavity preparations for the inlay are the same as for any other type of restoration, with only slight variations. It will be readily understood that an inlay cavity must be free from undercuts in the direction of the withdrawal of the pattern. As a general rule, this direction should be as nearly opposite to the stresses the inlay will have to bear as possible. Great care should be taken to have adequate resistance form. This is secured by having all cavity walls flat and true, and all line angles at as near 90° as possible.

Particularly is this true of the gingival wall or seat. It can be readily seen that if it presents approximately a 90° angle with the pulpal-axial wall, the stress of mastication will not tend to force the inlay out of the cavity. Retention form can be secured in several ways: (1) by increasing the width of the occlusal step at a point distal to its junction with the approximal step (this will give a strong mechanical anchorage on the dovetail principle); (2) by making a small square-walled excavation at the distal extremity of the occlusal step; (3) by inclining the pulpal wall to the distal (this will also increase the resistance form); (4) by undercutting both cavity and inlay before cementation in such a way that the undercuts will come opposite each other, thus keeping the inlay in with cement. It is evident that a combination of two or more or all of these principles can be used if desired. The walls of inlay cavities should be finished perfectly smooth by true running stones and copper laps used with fine carborundum powder. The slightest inequality will cause a more or less imperfect operation. All margins should be beveled to about one-half the depth of the enamel at an angle of 45°. As before stated, parallelism of cavity axial walls is desirable but as few of us are perfect operators, it is usually best to let the walls be slightly divergent, thus decreasing the possibility of undercuts.

Wax Pattern

In all compound and complex cavities a matrix is necessary. Wax is a plastic substance and if not confined will follow the path of least resistance; therefore, when forced into a cavity, without confinement, it will not be closely adapted to the cavity walls and margins, and will not be well condensed. A poorly adapted wax pattern will produce a poorly fitting inlay. Inadequate condensation will cause the pattern to have poor texture, and will cause many unrelieved strains within the mass of wax, resulting in form change, buckling or warping of the pattern when removed from the cavity. This peculiar phenomenon has been observed by many operators, and the remedies suggested have been many; all of which are time consuming, more or less laborious, and unnecessary if the wax is properly confined and condensed. Strains in any substance are caused by intermolecular disturbance resulting in drawing molecules apart. Cohesive force tends to draw the molecules together, especially under a rise of temperature and subsequent cooling. If an intermolecular disturbance is created in a mass of wax by manipulation while in a plastic state, many of the molecules will be drawn away from each other, resulting in the establishment of strains. The strains are relieved when the wax, having been chilled, is again heated, and the result is easily seen by the naked eye in many cases. However, if the wax is manipulated or molded while under pressure, thereby retaining the correct intermolecular relationship, and the pressure kept constant until the mass has cooled, no strains will result. The mass will expand and contract evenly when subjected to changes of temperature but will not buckle nor warp. Aside from these reasons, there is another in favor of use of the matrix, and that is the matrix band helps to form the pattern, thus rendering carving easier. The use of the matrix is simple and easy. In complex cavities of the M. O. D. type and the mesio-occlusal and disto-occlusal cavities, where the contact of the approximating tooth is not too tight, a full band matrix is used.

Either a soldered or seamless band or a strip of No. 36 gauge annealed copper may be used in the Onderdonk matrix retainer. I prefer the latter. After having fitted the band to the tooth rather loosely, its cervical edge is festooned to avoid injury of the gum. It is then trimmed to correct occlusal length, that is, so that the teeth may be brought in occlusion. Its approximal portion is then contoured so that the approximal form of

the pattern will be correct. The band is then filled about two-thirds full with softened Taggart's wax, centered over the tooth and pushed in; the open side is kept closed with the ball of the thumb. The patient is then instructed to close and move the mandible laterally, thus securing correct anatomical markings. The mouth is then opened and wax again subjected to continuous pressure by the ball of the thumb until it has been cooled. The excess is removed and the carving of the occlusal surface is roughly done. Matrix is then removed, and the pattern comes with it. Matrix is opened, pattern removed, cavity dried and pattern replaced. Carving is then completed, using thin, sharp carvers rather than melting and burnishing away the excess with warm instruments. Instruments with a square cutting edge are preferred; the carving is done longitudinally to the margin, allowing the edge to rest on the enamel, thus rendering it impossible to overcarve or expose the margin. Occlusal surface anatomy is reproduced to the most minute detail. The approximal is carved to form and the cervical finished with Hunt's Plastic Instruments Nos. 1 and 2. These instruments may be used slightly warmed. A very slight overlap of wax is left at the cervical. Instruments which carve to a predestined angle should not be used, as they limit the artistic ability of the operator and always produce inaccurate occlusal planes. All such so-called planes are really not planes but convex surfaces and they always present varying angles in their relationship to each other. It can thus be readily seen that no instrument with a predetermined angle can correctly reproduce an occlusal surface. In mesio-occlusal and disto-occlusal cavities, where the contact is too tight to permit the passage of a band, a different technic must be resorted to as follows:

No. 36 gauge copper matrix is ligated to the tooth somewhat loosely. A pellet of wax is softened and molded into an elongated cone, the apex of which will reach to the cervical seat of the cavity. It is then chilled, the apex softened, placed on the cervical seat and the whole quickly forced into the cavity. The harder interior portion will act as a plunger to force the softer exterior portion of the wax into close adaptation to all cavity walls and margins. The rest of the technic is the same as previously described. One point that should be accentuated is the following: If upon removal the pattern shows imperfections, no attempt should be made to repair it but a new one made. When carving is completed, a heated sprue is attached to the pattern at the point from which the casting is to be made and when the chilled pattern is removed, it should be washed with a 3 per cent hydrogen peroxide to remove all saliva, blood and mucus. It is then dried, mounted on the sprue-former preparatory to investing.

Investing

There are a number of investing materials on the market which will give excellent results when correctly used, but not when used in a haphazard manner. Directions for using are furnished with all good investments, and should be closely followed in making the mix. The pattern should be lightly dusted with French chalk and then carefully painted with investment, for which a fine-pointed brush is used. One should start at a given point and gradually spread out the investment until all surfaces are covered. The excess is then blown off and another coat applied. The balance is then poured into the ring, pattern inverted, and carried into the ring, taking care to get the sprue-former correctly seated. The case is then set aside until crystallization has occurred. It is then ready for "burning out."

Elimination of the Wax

The sprue-former is removed by carefully twisting it. The sprue is then heated and removed. Great care must be taken not to fracture the investment

around the sprue-hole, as loose particles may be carried into the mold and cause a defective casting. There are several methods of wax elimination, all of which are fairly satisfactory when carefully followed. The one most in use is by burning out the wax over an open flame, but in the careless, slipshod manner ordinarily used, it is far from satisfactory. A better method is to place the flask on a ringstand, sprue-hole down, about two or three inches above a very small Bunsen flame and subject it to a comparatively low heat for one and a half or two hours, thus slowly drying out the investment and volatalizing the wax rather than burning it out. This will not disintegrate or crack the investment, as does a higher temperature, and when properly done will leave a small amount of residue in the pores of the investment, which causes the surface of the casting to be bright and smooth. With a little practice one can soon learn the size flame to use and how long to apply the heat, which will, of course, depend somewhat on the size of the pattern. This method is open to the objection that it is somewhat inexact and leaves a great deal to the judgment of the operator. This is true, but with experience it will become possible to get very excellent results.

Some three or four years ago, I became convinced that a great improvement could be made in utilizing known temperatures in wax elimination, thus raising this process from the realm of guesswork to that of a truly scientific operation. Considerable experimental work was done along this line, with some gratifying results. It was found possible to make very good castings in an investment of plaster of Paris alone, thus showing that the wax could be successfully eliminated at a temperature below that at which plaster undergoes serious disintegration. If properly manipulated, plaster makes a good investment, but inasmuch as it is more difficult to use than other materials more suited to this purpose, its use is not advised. The lowest practical temperature for wax eliminations is 360° to 400°, or thereabouts. Small patterns will, of course, be eliminated much sooner than larger ones. The time required is from one and a half to two and a half hours, depending on the size of the pattern and also the size of the ring. The use of a small ring is advised.

About three years ago I made the statement that 320° F. was sufficient to eliminate the pattern in one and a half hours, but I now know that this is not true. A very small pattern may be eliminated in that time and at that temperature, but the average pattern cannot, and, inasmuch as just as good results from every other standpoint can be secured at higher temperatures, there seems to be no good reason why they should not be used. I have seen several clinics given, and also have read a number of articles advocating this temperature, (320° F.) but I have amply proved that uniformly satisfactory results cannot be secured at so low a heat. The reason for the apparent success of some of these operators is that the oven in which the work was heated was so crudely constructed that the actual temperature to which the cases were subjected was really much higher than the thermometer registered. Anyone can amply prove the truth of this by making tests with an accurate device. When an oven is used for elimination of the wax, the procedure is as follows:

The flask is placed in the oven (which has been previously heated to the maximum temperature which is to be used) as soon as complete crystallization of the investment has occurred, with the sprue-hole down. If a temperature from 360° to 400° is to be used, the time will be, as previously stated, from one and a half to two and a half hours, depending upon the size of the pattern. The sprue-hole being down, much of the wax will be eliminated by gravity, if the pattern is a large one. The rest of the wax will be absorbed by the investment material and will be gradually volatalized, but it is best that it be not completely eliminated

as a certain amount of residue in the pores of the mold will be highly advantageous.

Another method, which has proved satisfactory and which requires a much shorter time, is the following:

The oven is heated to a temperature of approximately 550° and the flask is placed therein as soon as crystallization has occurred. The heat penetrating thru the flask has a tendency to vaporize the free water in the periphery of the investment material. This vapor will force the contained free water of the investment inward and in seeking an exit thru the mold and sprue-hole it will wash the wax out. The flask is then left in only sufficiently long to dry the investment material thoroly. The time required by this method is from fifteen to twenty-five minutes, depending largely upon the size of the flask or ring used. Either method as described seems to give about equally good results.

Casting

Only good, clean metals and alloys are fit for casting. Every time a casting is made, the surplus should be thoroly cleaned by pickling and then fused with a good reducing flux. If this is done, and care exercised to avoid mixing the various alloys or contaminating them with solder or other foreign substance, a given piece of metal may be cast over and over again and a satisfactory result obtained.

The alloy to be used for a given case depends on the condition and location of the cavity. For Class 3 and Class 5 cavities 24K is sufficient, as these restorations have to withstand little, if any, stress. However, twenty-four karat is unsuitable for all other cavities. As a rule, gold, copper, silver, platinum alloy is best for all restorations which must withstand stress, the proportions of the metals being varied to give the strength and hardness required for different classes of work. It is evident that a softer alloy will be satisfactory for single restorations of good bulk, while a harder alloy will be required for thin restorations, or those which are to be used as abutments. One great advantage of the hard alloy over the soft (24K gold) is that it will withstand service without becoming worn and abraded, and will not be subject to so much interproximal wear. I will grant that in many cases twenty-four karat is much easier to use, as it can be more easily burnished and adapted to the margins; thus a poorly fitting inlay may be "doctored up" until it looks pretty well, but I can see no real reason why it should be used. The theory that hard alloys will not wear down as rapidly as the surrounding tooth structure, is without foundation, as observation will show that the hardest alloy will wear as rapidly as will enamel.

In casting, good results will be obtained by most of the devices in common use, but they must be correctly manipulated. Good results are even obtained by some men by means of a wet asbestos pad.

In fusing the metal, a good blowpipe with a small, hot flame, which is free from uncombined oxygen and carbon should be used. In communities having a good grade of artificial gas, a gas and air blowpipe can be used for all but the higher fusing alloys. This is good practice as it is almost impossible to overheat the metal with such a device. A gasoline and air blowpipe is also good. The blowpipe in most general use is the gas-oxygen device. When carefully used and the flame properly adjusted, it gives excellent results. However, its heat is intense and great care must be taken to avoid overheating of the metal. Overheating is the cause of many failures in casting; it not only causes serious disintegration of the alloy but super-heated metal injures the surface of the mold, thus producing a rough casting. Only enough heat should be used to thoroly fuse the metal and to keep it fused until it has been forced into the mold. The greatest need in casting operations at this

time is a better means of fusing the metal to be cast.

A great deal has been said in regard to whether the casting should be made in a hot or cold investment. A cold investment will usually give the best results. However, excellent results have been secured with a hot investment. In casting, a small amount of reducing flux can be used to prevent oxidation of the metal. When the cast is made, the ring is cooled in water and if the low heat technic has been correctly followed, the inlay will come out bright and smooth. It is then pickled in acid and excess cut away. In a perfect inlay space must be provided for the cement. All matter occupies space, and cement is no exception to this rule. Therefore it seems only reasonable that if an inlay fits well without cement that when the cement is placed in the cavity it will be impossible to get the inlay completely to place. This must necessarily be true. However, if the cavo-surface of the inlay is relieved, with the exception of one-half to one millimeter at the margin, space will be provided for the cement, and yet the margin will be intact. This will permit of the margin being in practically perfect contact and still permit of a good thickness of cement over the cavo-surface. This condition is brought about by first coating the margin and outer surface of the inlay with wax and immersing it in aqua regia for from ten to thirty minutes, according to the effect desired. The acid will dissolve away the unprotected surface. In addition to the advantage aforementioned, it will also be found that inlays so treated will go to place much easier and may also be removed more easily. Also, owing to the roughened surface, the cement will adhere much better. The greater thickness of cement over the dentin will greatly minimize thermal shock.

Finishing and Cementation

The inlay is tried in the cavity and brought to a seat by tapping with a mallet. All margins are tested with an explorer and thoroly burnished. They are then ground down flush with the tooth, using very small mounted carborundum points, such as Miller's thirty-two and a half and forty and a half. Cervical margins are finished with files and strips. The inlay is then surfaced, using brush wheels and rubber cups with powdered pumice. Care must be taken not to obliterate the fine lines on the occlusal surface. The contact point is now restored with 20K solder and the inlay tried in again to make sure if contact is right. The inlay is again removed and cotton rolls placed in position to keep cavity dry. The toilet of the cavity is made by swabbing it out first with 3 per cent hydrogen peroxide followed with phenol and then alcohol, and last of all, a blast of warm air. A thin coating of creamy cement is then placed in the cavity and over the inlay, which is then pressed firmly to place and tapped with a mallet, using a smooth-faced plugger. The cement should be wiped away from the margin to ascertain if the inlay has gone completely to place; if so, the margins are well burnished and as soon as the cement is well hardened, the excess is broken away and the inlay given a high polish, using brush wheels and rubber caps with dry chalk for this purpose.

It is highly desirable in all cases where occlusal restorations are constructed to have the patient return in two or three days for the purpose of ascertaining as to whether a traumatic condition exists. This will be evidenced by burnished spots on the surface of the restoration. These should be ground down and the restoration repolished. If this simple precaution is not taken very serious pathologic conditions may result.

Discussion

W. P. Smedley, Denver, Colorado: I fully agree with the essayist that the gold casting process as introduced by Dr. Taggart is the one great epoch-making innovation during our time.

Just why it was felt necessary by the essayist to compare the gold inlay with the gold filling and with an implied apology for the inlay is

not quite evident, for they occupy two quite distinct fields, the inlay field being much wider, covering the large number of cases where foil was a failure due to frail walls, inaccessibility of cavities, etc., and the much larger number of cases which were poorly cared for by amalgam and the abominable shell crown. The value of the inlay principle had been quite well proved with both porcelain and gold even before the introduction of the casting method, and the great strides that have been made since that time have conclusively demonstrated its merit.

The essayist's ten requisites for a filling material are good and well stated. I wish especially to commend his first, which calls for a complete and accurate restoration of the tooth form. This very sound principle has been stressed a great deal during the last few years but its importance is so great that it cannot be repeated too often.

I wish to heartily endorse the essayist's condemnation of the silicate cement as a permanent filling material and to especially censure the men who misrepresent silicate cement fillings to their patients as porcelain, but I wish to take exception to his statement that "foil is best for the great majority of anterior restorations" and to resent the fact that he has not even mentioned the porcelain inlay or porcelain jacket for this particular service.

In opening the subject of technic the essayist states that it is "the intention of this paper to describe a certain technic" but the impression conveyed is that there is quite a variety of methods, any of which will give good results if carefully followed. It is to be regretted that he was unable to select a technic that he would be willing to claim as "superior to every other."

"Cavity preparation," the first step in the process is very well covered, especially in reference to retention. However, if the advice in regard to the importance of flat walls and 90° preparation thruout, and as he says, particularly in regard to the gingival wall, were taken too literally it would result in unwarranted destruction of tooth structure and unnecessary weakening of the side walls. The greatest stress of mastication comes in the lateral motion, so that the base of the buccal and lingual walls should be left as thick as possible. Aside from this, parallelism—if possible—would not be desirable, for axial walls slightly diverging permit of a closer adaptation of the gold to the cavity by allowing the inlay to settle uniformly into the cavity to accommodate the approximately 2 per cent shrinkage of the cast gold.

The essayist lays great stress upon the importance of the complete elimination of the slightest undercut or irregularity in the cavity walls and he gives us a very good method of accomplishing the desired result. A 45° bevel to one-half the thickness of the enamel would answer well on occlusal surfaces but would be insufficient for the approximal margins where a much broader bevel may be needed to remove the outside undercuts of bell-shaped teeth or to bring the margins of the inlay into self-cleansing areas without unnecessarily enlarging the cavity. A very important bevel which is not mentioned in the paper is that at the gingival margin. This bevel eliminates the short enamel rods and obviates the necessity for the "slight overlap of wax at the cervical," which is recommended by the essayist.

His treatise upon the properties of wax is somewhat bewildering but the best way to avoid these apparent eccentricities of wax is not to manipulate it before introduction into the cavity but by using a wedge of cast or carved wax to such shape that the point will reach the gingival seat without binding at the sides. To have the point well softened use the larger and harder end as a plunger to force it into the cavity, not "quickly" as the essayist advises, but with a slow, steady, firm pressure which will carry the wax definitely to place; the pressure should be maintained until the wax has had time to come to a uniform open mouth temperature before the carving is done. In proximal occlusal cavities a hand matrix properly shaped to bridge the space from below the contact surface to the gingival margin will probably best guide the wax to its proper place and will not leave the contact to guesswork. The firm pressure upon the wax serves to separate the teeth sufficiently to afford a tight contact and the accurate impression obtained of the adjoining tooth produces a facet upon the finished inlay which assures a normal contact surface. Of course in the case of isolated teeth a band matrix is essential and a good one may be made with the combination punch and riveting pliers, thus having a band which may be very readily opened after the wax is settled to place and the trimming of the model completed without the removal and replacement of the wax into the cavity.

The essayist well points out the importance of faithfully reproducing the occlusal anatomy of the teeth and the impossibility of accomplishing this with an instrument which carves to a predetermined angle. These statements meet with my unqualified approval.

When the pattern is completed it is well to mount it on the crucible-former, if it is to be invested immediately, which is of course best, but if it is necessary to be left uninvested for a time the wax will be best safeguarded against change of shape if it is placed in a small glass jar containing water at room temperature.

The essayist has said little about investing and has said it very well. I wish, however, to call attention to the importance of deferring the painting of the investment upon the pattern until the process of crystallization is well advanced, when it may be laid on in a smooth

and thick enough layer to retain its position during the subsequent flasking. This dense coating acts as a filter allowing the air in the model to pass thru but not permitting the gold to penetrate the surface as is the case where a thin, watery mix has been applied to the wax. The filling of the flask may better be done after it is correctly seated upon the crucible-former, thus giving a better opportunity to see that no air globule is caught under the pattern or any injury done to it.

The essayist has said so much about elimination of the wax and said it so indefinitely that I am taking the liberty of giving you briefly some of the conclusions reached by the Denver Inlay Unit. The wax must always be burned out within an hour but preferably immediately after the investment is set. The casting can be done as soon as the mold is cool but need not be done then. The elimination of the wax must be under such control that it can be done with rapidity but without bubbling, boiling or even welling up in the mold for wax explosions within the mold damage the surface. The water must be driven out of the investment first and then the heat of the flask raised to the point where the wax will permeate the water-freed investment. The heat should then be raised to the point of carbonizing the wax. The coating of carbon on the surface of the matrix will deoxidize the gold and the casting will come out with a velvety, smooth surface. If the investment is heated too slowly it will deteriorate and change form.

Under the heading "casting" much space is given to a consideration of the many difficulties incident to the use of alloyed golds. My firm belief is that 24K gold with 2 to 4 per cent platinum where needed is far superior to any other alloy, manufacturer's propaganda notwithstanding. The one outstanding advantage of the gold inlay over the more aesthetic porcelain is the elimination of the cement line and this is largely lost by the use of hard alloys.

Casting in a cold mold is unquestionably best, for a hot mold is a distorted mold. Quick heating of the gold is the only way to accomplish this and it probably can best be done with the oxyacetylene jet. The air and gas blowpipe will inevitably heat the mold before the gold is sufficiently hot.

The use of reducing flux during casting has been responsible for many shiny margins.

I am not convinced of the soundness of the essayist's theory of the strength of cement and still cling to the old theory "the thinner the cement the tighter it sticks," that is, the closer the adaptation the stronger the union. Tho an inlay fits perfectly the elasticity of the dentin would permit of complete seating, and the crystalline nature of the small portion of the cement left unexpelled, in conjunction with the resiliency of the dentin, affords the strongest possible union.

We have reached the final heading—finishing and cementation. Even tho I were very confident of the perfection of my inlay I would hesitate to seat a hard gold inlay upon first introduction into the cavity by "tapping with a mallet." Teeth have been split. It sounds as tho the grinding, filing and stripping were to be done in the mouth. I believe that is done by some but it is not kind to the patient, nor does the very high polish of gold in the mouth enhance its aesthetic value or its usefulness.

In setting the inlay instead of using a thin coating of cement within the cavity it is well to almost fill the cavity to avoid the possibility of trapping air.

A. C. Young, Wilkensburg, Pennsylvania. One of the steps seems to need special emphasis. He states: "if the wax is manipulated or molded while under pressure, thus retaining the correct intermolecular relationship, and the pressure kept constant until the mass has cooled, no strains will result." It seems to me that even with constant pressure while cooling strains and stresses must result that will be affected by any further change in temperature. Probably more failures result from improper handling of the wax than from any other cause. A number of operators have been obtaining best results by the practice of keeping the wax at a constant temperature after it has cooled, carving, if possible, without removal from the cavity until the sprue is applied.

I would have been better pleased had the essayist presented a simple scientific procedure for each step. With his wide experience and ability, and the knowledge of the results he wishes to attain, it is simple to him, but he may mislead some of us, who are novices, into being careless, inasmuch as he gives us the general idea that anyone of several methods may be followed with equally good results. I doubt whether this can be done by the man without his experience and ability. Possibly he could have instructed us to obtain better results had he presented the one best method for each step.

RESULTS OF EXPERIMENTAL STUDIES ON FOCAL INFECTION AND ELECTIVE LOCALIZATION[1]

By E. C. ROSENOW, M.D. Rochester, Minnesota

MANY facts indicate that localized infections, often insignificant and symptomless in themselves, may be the source of systemic disease. Focal infections are present in demonstrable form in a high percentage of the sick. Thoro removal of foci of infection is followed by improvement in general health and frequently by improvement or cure of distant local and systemic diseases, provided such diseases are not too far advanced.

Experimental studies have shown that foci of infection in a given case may harbor the same types of bacteria as are found in distant lesions; that intravenous injection of the freshly isolated strains into animals, both from the focus and from the diseased organs, is followed by localization and lesions in organs corresponding to those involved in the patient from whom the bacteria were isolated; and that, from the lesion produced experimentally, the organism may be isolated in pure culture, the disease again reproduced, and the organism again isolated. The usual requirements for the demonstration of causal relationship between extraneous parasites and diseases were fulfilled.

During investigations on the transmutation of pneumococci and streptococci the author found that variation in oxygen tension and growth in symbiosis with other bacteria tended to produce marked changes in this group of organisms, and that when strains of low virulency were rendered more virulent by successive animal passage, localization shifted from areas of relatively low available oxygen supply, such as heart valves and periarticular structures, to those of higher oxygen supply, such as the muscles, myocardium, stomach, gall-bladder, kidneys, and lungs. By the use of special methods in which a gradient of oxygen tension was afforded the bacteria and in which fresh cultures were injected intravenously into animals, it became apparent that the specific infecting powers of the bacteria in the focus were the chief factor that determined the place of localization in remote structures.

It has previously been shown by the author that streptococci isolated from foci and systematic lesions tend to localize electively in the respective tissues in appendicitis, ulcer of the stomach, cholecystitis, rheumatic fever, erythema nodosum, herpes zoster, myositis, chronic septic endocarditis, and epidemic parotitis. More recently he has reported similar results in diseases of the nervous system, such as transverse myelitis, multiple neuritis, neuralgia, and epidemic poliomyelitis in disease of the eye, and nephritis.

Inability to obtain evidence of the elective localizing power of bacteria in the hands of some observers may be ex-

[1]The original paper, of which this is an abstract, was read before the American Medical Association, Boston, 1921, and was published in the *Medical Clinics of North America*, V (1921), 573-92.

plained by insufficient attention to details. The condition of oxygen tension of the culture, the size of dose injected into an animal and the age of the animal used may each be of great importance in the successful performance of localization experiments.

The author's primary consideration was to determine whether or not foci of infection harbored bacteria which might produce in animals a disease corresponding to that found in the patient. An intensive effort was made to work with bacteria from the depths of a focus and not with those on the surface which might be saprophytic flora, and, with this end in view, pus was expressed from tonsils and aspirated from the depths of pockets in cases of pyorrhea.

Streptococci from certain foci often give negative results when cultured aerobically, while positive results are obtained with the same organism cultured in tall tubes of dextrose brain broth which offer a gradient of oxygen tension. Aerobic cultivation tends to destroy promptly the property of which elective localization depends, whereas partial tension cultures tend to preserve it for a longer time, especially if subcultures are made as soon as abundant growth has occurred.

Altho comparatively large doses of streptococci were used by Rosenow in his earlier work, it was found that in some instances exceedingly small doses sufficed to produce specific lesions, as, for example, in the case of herpes zoster, where the few streptococci obtained in the filtrate of ascites-glucose-broth culture localized and produced lesions in the posterior root ganglia, and herpes of the skin in the corresponding segment. The objection which has been raised regarding dosage has been met by injecting smaller doses of cultures and by directly injecting salt-solution suspensions of the relatively small number of bacteria from tonsils. Thus, in myositis, thirty-four of a total of thirty-five rabbits injected developed lesions in muscles.

Smaller doses of streptococci are now used, usually from 0.5 to 5.0 c.c. of glucose-brain-broth for medium-sized rabbits. This broth is made by adding to plain peptone broth 0.2 per cent of glucose. The reaction is adjusted to plus 1 and to a hydrogen-ion value of 6.7 to 7.2. The medium is placed in tubes 20 cm. by 1.5 cm. which are filled to a height of from 10 to 12 cm., and contain approximately 2 gm. of brain substance and several pieces of marble. It was found that pieces of brain decolorize methylene blue, render the bottom of the tube sufficiently anaerobic to grow tetanus spores, and lower the surface tension to a considerable degree. This medium has given excellent results and is specially favorable for the growth of streptococci.

Results

A table is given summarizing the results obtained from a study of the elective localizing power of streptococci from a series of cases of appendicitis, ulcer of the stomach, cholecystitis, myositis, acute poliomyelitis, neuritis and sciatica, and comparing the results with those obtained by the injection of streptococci from miscellaneous sources. The highest incidence of lesions in the animals occurred in the organ which was chiefly affected in each of the diseases studied. The next highest instance of localization occurred in structures which are not infrequently involved as associated conditions in the respective diseases. In the miscellaneous group, no high incidence of localization occurred. The table does not adequately express the remarkable specificity of some strains of streptococci. If the condition in the patient was relatively acute, the lesions in animals were prone to be more pronounced, and in cases of myositis the strepto-

cocci not only tended to localize and produce lesions in muscles, but the location of the lesion often approximated that noted in the patient. In pregnant rabbits localization occurred not only in the muscles of the parent rabbit but also in the fetuses.

Localization in the myocardium, especially in His's bundle, with development of arrhythmia of the heart following the injection of cultures from pyorrheal pockets in a case of impaired myocardial conduction not due to syphilis, is another striking example of the extreme specificity of some strains of streptococci for certain tissues. This narrow specificity for certain tissues is in keeping with the fact that myositis occurs during certain epidemics of respiratory infections and with the striking example of elective localization in a widespread epidemic of myositis reported by Curschnann, in which the muscles of the neck were chiefly involved.

The foci studied included pyorrhea, apical infections of teeth, suppurating dental sinuses, infected tonsils, and infections of the prostate gland. Not all foci yielded streptococci having elective localizing power.

Evidence has been obtained which indicates why infections in certain foci remain symptomless and at the same time may be the source of metastatic infections. Microscopic sections show that the bacteria are not usually encapsulated in the thick wall of connective tissue of granulomas remote from blood-vessels, as is commonly assumed. Their situation is chiefly along the periphery and near newly forming blood vessels, and, opportunity for drainage into the circulation appearing ample, swelling and tension do not occur, while the focus remains unsuspected because there are no local symptoms.

It has happened repeatedly that streptococci in cultures from the pus in well-formed abcesses in extirpated tonsils and from the pus exuding from pyorrhea pockets failed to produce lesions, when, at the same time, the streptococci in cultures from emulsions of the washed tonsils and from the pus aspirated from the depths of the pyorrhea pockets localized and produced lesions in the tissues corresponding to those involved in the patient. Cultures on blood agar and smears failed to reveal any noteworthy difference between the two sets of cultures. Prolonged contact of bacteria with leucocytes in pus and a high oxygen pressure in mucus on the surface of mucous membranes appear to reduce the invasive powers of the bacteria.

Goiter

A series of animals have been injected with a diptheroid-like streptococcus obtained consistently from the thyroid gland in cases of goiter. One-half of sixty-eight animals injected showed gross lesions of the thyroid, while microscopically most of the animals showed marked dilatation of the blood vessels and hemorrhage into the interstitial tissue in from one to four days after injection. Bacteria were usually not demonstrable.

In a series of sixteen dogs that were injected repeatedly and allowed to live for from twenty to seventy days after the first injection, loss in weight and enlargement of the thyroid gland occurred, and diarrhea developed. One developed, in addition, softening, pulsation, and bruit of one lobe of the thyroid, associated with tachycardia and tremor.

A watery appearance on cross-section of the thyroids was usual in the animals that developed symptoms. Microscopically there were found vacuolation and irregular staining of the colloid, colloid within vessels, areas of necrosis, and a variable degree of hyperplasia,

which in some instances was extremely marked. Micro-organisms were either few or not demonstrable.

Vagotonic Neurosis

In each of three patients suffering from vagotonic neurosis who were studied, one or more animals injected intravenously with cultures from the pus expressed from the tonsils developed hemorrhage and edema due to localization of streptococci in the vagus or sympathetic ganglia or nerves. In one of the animals, hemorrhage and edema were found in the splanchnic nerves, associated with hemorrhage and ulceration of the mucous membrane of the stomach.

Lesions of the Pancreas

Acute pancreatitis occurs commonly in epidemic parotitis and less often in epidemic influenza. Interstitial pancreatitis, often associated with cholecystitis, is thought to be the result of ascending infection thru the pancreatic ducts, since the lesions are usually more marked in the head of the pancreas. Results have been obtained which may have a direct bearing on the diseases of the pancreas.

Lesions of the pancreas occurred in 26 per cent of 19 animals injected intravenously with the streptococcus isolated from Steno's ducts in epidemic parotitis, in 3 per cent of 168 animals injected with the ulcer strains as isolated, in 17 per cent of 39 animals injected with these strains after several animal passages, in 5 per cent of 41 animals injected with cholycystitis strains as isolated, and in 19 per cent of 16 animals after animal passage. Only 3 of 217 animals had lesions of the pancreas following injection of streptococci as isolated and after animal passage from appendicitis, herpes zoster, erythema nodosum, and myositis. When lesions of the pancreas developed, they were usually severe and most marked in the head, and consisted of edema and diffuse and circumscribed hemorrhages, usually associated with fat necrosis. Sections showed separation and degeneration of the parenchymatous cells, edema, hemorrhages, infiltration of interstitial tissues, and diplococci. There was relatively little change in the parenchymatous cells or Langerhans' islands.

By these experiments, support is given the idea that interstitial pancreatitis may be due to streptococci that gain entrance thru foci of infection harboring bacteria which have elective affinity for this organ, and that ascending infection does not always occur. The possibility that the degeneration of Langerhans' islands in pancreatic diabetes is due to organisms having affinity for these structures is suggested by these experiments. The history of acute infections sometime previous to the onset of diabetes, especially in children, also suggests this possibility.

Lesions of the Eye

Iritis has been produced in rabbits with streptococci isolated from the infected pulps of teeth in patients suffering from iritis in six of nine animals injected. In one, parophthalmitis, with hemorrhage in the retina, resulted. In the other, swollen, whitish areas and hemorrhages in the retina were demonstrated with the ophthalmoscope or by microscopic examinations of sections. Streptococci were demonstrated in the lesions. Ophthalmoscopic examination of a series of rabbits injected with cultures from foci in other diseases revealed no lesions of the eye.

Endocervicitis

Intratracheal injection of the primary and secondary cultures of a green-producing streptococcus obtained from the vaginal discharge of a girl of three years whose vaginitis developed during an attack of influenza, produced, be-

sides hemorrhage, edema of the lungs, lesions with purulent exudate in the uterus and vagina of each of three female guinea-pigs injected.

A partial tension streptococcus found in large numbers in cervical or vaginal pus in each of nine patients produced, on intravenous injection into rabbits, localization in the cervix, uterus or vagina in all but one of nine instances.

Nephritis

The kidneys of animals injected with streptococci isolated from the prostatic fluid, shreds in the urine, and from the extirpated tonsils in a case of chronic interstitial nephritis, showed only slight changes aside from small necrotic areas, chiefly in the cortex. Following the injection of the streptococcus obtained from the tonsillar or dental foci in three cases of acute nephritis, the kidneys developed larger, more acute focal lesions in cortex and medulla, with moderate diffuse edema and cloudy swelling. Streptococci were easily demonstrable in the focal lesions but not elsewhere.

A strain of staphylococcus was isolated from the tonsils and washings of the maxillary sinus in a case of advanced nephritis; on intravenous injection this strain proved to have a marked affinity for the kidneys of rabbits. The two lower cuspids in four dogs were devitalized in a sterile manner and the pulp chambers injected with a culture of the staphylococcus obtained from the kidney of one of the rabbits with marked nephritis. In periods of over one and one-half months from the time of inoculation, each of the four dogs developed a disseminated nephritis involving both cortex and medulla and albumin, pus, and blood-cells were found in the urine. In three dogs the lesions remained limited to the kidneys, while in one, marked pyelitis and cystitis developed. The mucous membrane of the pelvis and bladder wall in this animal was edematous, infiltrated, and contained many areas of hemorrhage. Adherent to the mucous membrane were many long nonlaminated, rough pumice-like concretions extending in a fan-like manner from the base of the bladder up along the blood vessels. The ureters contained a number of similar concretions. This result suggests strongly that infection by bacteria having an elective affinity for the urinary tract may be an important factor in the formation of stone.

THE RELATIONSHIP OF DENTISTRY TO OPHTHALMOLOGY

By ROBERT BLUE, A.B., M.D., Chicago, Illinois

OPHTHALMOLOGY and dentistry are similarly regarded by a vast number of people. The treatment of diseases of both the eyes and the teeth is too often regarded as disassociated with the treatment of pathology in other parts of the body. The fact that the eyes and the teeth are but highly specialized organs of the body, participating in many of its diseases and reflexly influencing the functioning of the entire body, is lost to view. While this fact may be known as an abstract idea to many occulists and dentists proper emphasis is not given to it.

The most striking example of the close association of the eyes and the teeth in a pathological syndrome is in that classical triad of symptoms known as Hutchinson's triad, which is pathognomonic of hereditary syphilis. Strangely enough the findings of this triad are distributed among three highly specialized departments of medicine, viz.: ophthalmology, otology, and dentistry. Almost invariably with the interstitial keratitis, the deafness, and the typically malformed teeth of the second dentition constituting this triad will be found other changes indicative of hereditary syphilis. These changes we will not dwell upon here, but it might be worth while to note that the typically pegged and notched teeth of the second dentition are not the only changes wrought in the teeth by this disease. Normally the molar teeth are inverted truncated cones, i.e., they are narrower across their necks than across their crowns—cauliflower-shaped, as it were. They are truncated cones with the cutting surfaces corresponding to the bases of the cones. Attention has been called to the fact that in hereditary syphilis the molar teeth are truncated cones with the bases of the cones at the gingival margin, so that in this case they are narrower across the crowns than at the necks.

Less universally recognized is the association of diseases of the teeth and of the crystalline lens. At first thought this might appear to be a far-fetched theory, but when it is remembered that embryologically the teeth and the crystalline lens are both ectodermal in origin, it no longer seems strange that some points of contact should remain unimpaired thru the various processes of differentiation. When this fact is taken into consideration it seems no longer strange to find a profound constitutional disturbance producing pathology in the teeth and the crystalline lens. Rickets furnishes an example of this association.

The changes wrought in the teeth by rickets are characteristics and often profound. In the milder cases the enamel is furrowed horizontally. The incisors show this horizontal furrowing most plainly, tho it may be marked on all the teeth. Carried to greater lengths

these changes result in the familiar terraced teeth of rickets. In the still more severe cases the teeth are aborted and the enamel is wanting in part or even in whole, the latter condition obtaining only in the most severe and neglected cases.

There is a type of cataract found in the eyes of children to which the names lamellar and perinuclear have been applied. This is the most frequent type of cataract found in children. Its association with rickets is sufficiently frequent to have given rise to the theory that it is the result of rickets. We know from clinical experience that in children we frequently find rachitic teeth associated with lamellar cataract, and we also find both embryological and theoretical reasons why the teeth and the eyes should be thus drawn together in a clinical picture.

In the cases sighted the pathology in the teeth and the eyes is a manifestation in these organs of a common general disease (provided, of course, that in the latter case the theory of Horner as to the cause of lamellar cataract is accepted). There are, on the other hand, frequent illustrations of diseases of the teeth being the direct cause of disease in the eyes or their appendages.

In this connection I need but call your attention to those cases of orbital cellulitis, where the retrobulbar phlegmon is a direct extension from a suppurative periostitis of the alveolar process of the superior maxilla. In these cases the inflammation in the orbital tissues occurs as a direct extension from periostitis of the teeth or appears after the extraction of diseased teeth. I do not want to convey the idea that dental disease is a frequent cause of orbital cellulitis by direct extension, but that dental disease must be included in the etiological causes of orbital cellulitis is beyond question.

More obscure perhaps from the standpoint of diagnosis than any of the conditions mentioned above are those cases of painful and irritable eyes which are due to reflex causes. I refer particularly to those eye symptoms which find their primary cause in stimuli applied to the terminations of the fifth nerve in and about the dental mechanism. The fifth nerve is not an intelligent localizing nerve at all times. Stimulation of the terminations in one branch is likely to be interpreted in terms of pain to some other point than that to which the stimulus is applied. The pain may be referred to some other branch or division of the nerve. Thus in the headache of eye strain the stimulation to the branches of the fifth nerve located in the eyeball, particularly in the ciliary body, is referred to the meningeal branches.

In a similar manner stimulation of the terminations of the fifth nerve in the upper jaw may be interpreted in terms of symptoms in the eyes. There is, of course, no reason to assume that the stimulation must be applied to the terminations of the fifth nerve in the upper jaw rather than elsewhere in the distribution of this nerve. I mention it in this manner for the sake of emphasis only and for the further reason that in the most striking examples of eye symptoms due to dental irritation which have come under my observation the point to which the stimulation has been applied has been in the upper jaw. An illustrative case may serve to still further emphasize this point.

The case is that of a young man who was troubled by recurrent attacks of pain, lacrymation and redness of the left eye. Cold, wind, or an unusual amount of use would initiate an attack, according to his history. So persistent and annoying were the attacks that he discontinued his college career on account of them. I placed him in the hospital and thoro physical examination by a competent internist re-

vealed nothing except a crowned and apically infected upper incisor. Proper treatment of the dental condition cut short the attacks.

In this group of cases we must include those cases of unerupted teeth which by their irritation to the terminations of the fifth nerve in the jaw cause reflex eye symptoms.

Many of the inflammatory diseases of the eye are either the result or the manifestation of general bodily disease. That a localized focus of pyogenic organisms growing and confined in some distant organ is a frequent cause of inflammation in the eye is, I believe, open to question. That it may occasionally be the cause of such inflammation in the eye is doubtless true; that the finding of such a focus of infection in conjunction with an inflamed eye proves the focus of infection to be the cause of the inflamed eye is not true. It is not true even tho no other cause for the inflammation is found. It is a conclusion based upon exclusion. To be absolutely accurate I may say that it is a conclusion based upon possibly partial exclusion. It is a conclusion upon which both you and I often base our treatment. But it is a conclusion after which a question mark must always be placed.

The beauty of the theory lies not so much in its scientific accuracy as in the fact that it calls our attention and the attention of our patient to a condition which never does good and can only do harm; which tends toward evil and should be eradicated. It should be eradicated whether or not it is the cause of the pathological manifestation for which we are seeking a cause.

These brief remarks are not intended to decry the whole theory of focal infection but to check its unbridled acceptance as the final etiology in all disease.

Reminiscences of Forty-five Years in Dentistry

By C. N. JOHNSON, M.A., L.D.S., D.D.S., M.D.S., F.A.C.D., Chicago, Illinois

II

IN THE days of which I write dentists were not so numerous as they are at present, and there were many small towns and villages without a dentist. It was the custom for practitioners from the larger places to make monthly visits on regular dates to the small towns, and it became part of my routine duty to accompany my preceptor on these trips, and later, in an emergency, to fill the "appointment" myself. The experience gained in this way was invaluable. Being thrown on my own responsibility I was taught a self-reliance that I could have gained in no other way. No matter how difficult a situation developed, I had to meet it, and meet it I did after some fashion. I am banking on the fact that most of the dear people for whom I worked in those days are long since benevolently "gathered to their fathers," and so I am safe in acknowledging that some of the work I did was a crime to civilization. Much of it consisted in extracting teeth and roots, and inserting dentures—"putting in plates," we called it.

I have a great deal of respect—and sympathy—for our expert exodontists of today. (That word "exodontist" if sprung upon a practitioner of those days would have keeled him over, and knocked him out "for the count.") They do things which compel my admiration—and occasionally my profanity—but I would take the best of them and place them in the same environment that surrounded me in the seventies and I would pit that raw youth against them for getting results. Think of the facilities—no anesthetics of any kind in those out-of-the-way places, an ordinary kitchen or rocking chair, and a very small assortment of forceps. Most of the cases that came to us were neglected beyond redemption—great hollow roots with little chance for securing a grip on them, and, on the other hand, immense molars set solidly in the jaws with merely a pulp exposure—all were "grist for the mill." And the results, as I look back over them, were really wonderful. Shutting one's eyes to the shame of extracting many of the teeth, I feel that in all humility I may claim much credit for the skill with which we accomplished it.

And at this point another reflection forces itself upon me in connection with some of our modern practices. We hear much today of the necessity of curetting the sockets after the extraction of teeth, a procedure which, to my mind, is being very largely overdone. I do not deny the advisability of doing this in certain rare and exceptional cases, but in the days of which I write the practice was never heard of and its necessity never imagined. In all of the numberless cases of extraction that came under my personal observation I never knew one which did not promptly get well after the tooth

was out, and in the very nature of things we were called upon to extract teeth that had been neglected beyond belief, and upon the roots of which abscesses had existed for years.

I am perfectly willing to admit that the manifestations of infection may vary according to periods and environments, but I do not at all agree with the theory that the extraction of most teeth necessitates scraping the socket. When I hear the marvelous stories told by people whose friends have had such dreadful cases where six or eight—sometimes as many as seventeen—good-looking teeth have had to be taken out "and then the bone scraped where every tooth was, and the gum all sewed up, on account of the terrible infection," I wonder. And I wonder still more when in answer to the question as to whether or not the teeth had been giving trouble, the statement is made that they were not, but that the dentist had said that "they were slowly poisoning the patient." *O tempora! O mores!*

I trust I am in favor of progress. I want to see things done today that were never dreamed of when I was a student; I want to see many things, which we did then relegated to oblivion; but when the day comes that we give ourselves over entirely to theorizing and ignore wholly the experience of years of clinical observation, I feel that the welfare of our patients is not likely to be conserved, and that we are not making progress in the true sense of that term. An innovation is not necessarily advancement, and the practice of curetting so many sockets is not real progress.

Some of my experiences in extracting teeth in those days had their humorous side, and some of course, from the patient's point of view, their pathos. As I look back over it now I marvel how I ever escaped breaking jaws or doing some deadly damage. For a long time my favorite forceps for extracting lower molars was the "cow-horn," and if anyone can look at such an instrument today and imagine how it could be used with the least degree of safety he has a good imagination. And yet I have rolled out many a stubborn molar with it, and never to my recollection did I have a mishap, which leads one to recall the old adage, "A fool for luck."

I had an amusing experience one day in extracting a lower molar from a sturdy Scotchman. It was at a farmhouse and I seated him out in the yard in a kitchen chair, which saved the necessity of a cuspidor. One used one's ingenuity in those days. He stipulated that when I got the tooth started I should stop and give him a rest, and then complete the operation at another pull. I was non-commital in the matter, not having the slightest intention of acceding to his request. But the roots were divergent and when I had lifted the tooth so that it impinged against the two adjacent teeth he threw both his hands over mine and I would have been obliged to lift Scotchman and all to have proceeded further. So I released my hold, and he took a heavy breath or two and nodded for me to go ahead again. I then removed the tooth without difficulty, and he looked up with his mouth full of blood and said complacently: "I like to have a raste between."

One poor boy in the same farmhouse got the surprise of his life. He was bent on having a tooth extracted, altho I told him it did not need to come out. He assumed a very superior air and said he had no faith in filling teeth, insisting that this tooth should be taken out. I saw that he had not the slightest conception of what was involved in the extraction of a tooth, but he was so very "fresh" in his demeanor that I concluded to gratify him. When he felt the terrible crash of that steel on his tooth he began to howl, and motioned me to stop. But I had the grip on him, and, wiggle as he might, the tooth came out. He seized his jaw with both hands and danced around the yard, shrieking like a wild Indian, and finally he landed face down

flat on the grass, all the while yelling that his jaw was broken. I have never enjoyed the sight of suffering, but there was something so ludicrous in his change of demeanor that I found it difficult to restrain myself. Of course, his jaw was not broken, nor was he otherwise injured, save that his point of view had been changed regarding the simple operation of extracting a tooth.

On one occasion when I was accompanying my preceptor on a trip, a patient requested the extraction of an upper cuspid. It was sound but stood alone, and was to be removed for the insertion of a full upper denture. It looked as if it were set in the jaw to stay—and it was. My preceptor was a slight man, none too powerful, but quite expert in wielding the forceps. He approached that tooth with the utmost confidence, but he met his Waterloo. He tugged, and heaved, and wrenched until he became red in the face, but the tooth remained serenely seated in the jaw. He stopped to get breath, when the patient looked up at him wonderingly and asked: "Was you pullin'?" I shall never forget the expression of disgust on my preceptor's face. He said not a word, but handed the forceps to me, and turned away—a defeated man. I was "huskier" then than I am now, and I determined that something should happen to that tooth. The end of the root must have been curved because I snapped it off about five or six millimeters from the apex. Even then I brought enough in length for any ordinary tooth, and the patient did not ask if I had been pulling.

Speaking of farm houses reminds me that at times where distances were great we were obliged to carry our tools and instruments with us in the buggy, and to construct a set of teeth before leaving the place. I have done this many times, making a laboratory of the kitchen and carrying the case thru from taking the impression to the insertion of the finished denture in the mouth. We vulcanized with kerosene, and ground the teeth and polished the plate with a small hand lathe which we screwed to the kitchen table.

If there were any teeth to be filled, it all had to be done with hand instruments, such as excavators and hand drills. I did not use a foot engine till I had been a student several years. The hand drills were as long as ordinary excavators, and to protect the palm of the hand a ring was worn around one of the fingers from which extended down into the palm a bar at the end of which was a spoon-shaped receptacle for the end of the drill handle.

I cannot resist the impulse to ask how well a dental student of today would acquit himself if handed an outfit like that, and asked to construct dentures and perform operations on the teeth? The boys of the present sometimes think they have rather difficult problems to solve in their college course, but compared with the times of which I write, they are put thru on velvet cushions and pneumatic tires.

(*To be continued*)

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Editorial Department

THE RELATIONSHIP BETWEEN THE PHYSICIAN AND THE DENTIST

There is in sight the dawning of a better day for those patients who are conjointly served by the medical man and the dentist. In the past—particularly the recent past—much inquiry has been done thru lack of co-operation and consultation in cases of systemic trouble where the teeth were involved—or were supposed to be involved. Too frequently the physician has gone his way regardless of the dentist, and the den-

tist has gone his way regardless of the physician. This is all wrong, and it is this which is to be remedied—must be remedied. The dentist in his attitude toward the teeth and their possible relation to systemic disorders must have an open and alert mind, and must leave no stone unturned to eliminate foci of infection in the mouth wherever they are demonstrated. He owes this to the physician and the patient. On the other hand he must not permit himself to be stampeded out of common sense and reason, and submit to the extraction of every suspected tooth in his patient's mouth merely because a physician orders them out. In recent years physicians have acquired an altogether exaggerated suspicion that the teeth were at the bottom of nearly all the ills of humanity, and too frequently they have condemned the teeth without a sufficiently careful investigation of these organs, or without looking farther to see if by chance some other organ or organs might not be at the seat of the difficulty. In other words the medical man and the dentist have been working at cross purposes, and this has resulted in much harm and injustice to the patient.

Dentists need the greater breadth of vision to be gained by association with physicians whose work takes them into a wider field, and whose daily routine is broader and more comprehensive. And conversely when this is acknowledged, it may not be presumptious or out of place to contend that when it comes to conditions in the mouth the physician should have as much respect for the opinions of the dentist as he demands when the situation is reversed. Dentists have been making a conscientious and intensive study of the oral cavity and its contents ever since the first dental college was established in 1839, and it would be a very strange thing indeed if they had not acquired a more intimate knowledge of these parts than the medical man, whose college training gives him at most only a cursory consideration of this subject. We believe we are well within the mark when we say that it is not with most dentists a question of prestige at all. It is simply that the patient may be better served, and not so much imposed upon.

Many a hopeless victim is today suffering the loss of valuable teeth without the slightest physical benefit, due wholly to an overzealous conviction on the part of the medical man that the teeth are accountable for most of our physical ills. In the past the dentist found it difficult to interest his medical colleagues in the significance of the teeth, but when the time came that the latter began to concentrate on this subject they carried it beyond the bounds of reason into the realm of fanaticism.

Now there is a strong hope that all this is to be changed. Medical societies and dental societies are meeting in conjunction, and the great

good that will come from this cannot be estimated. Two notable examples are the North Shore Branch of the Chicago Medical Society and the North Shore Branch of the Chicago Dental Society—whose January meeting was held together—and the Academy of Medicine of New York, with the First District Dental Society on February 2. The officers of these organizations are entitled to the gratitude of medical men and dentists everywhere, because out of such co-operation as this is to come the greatest measure of good, not only to the professions but particularly to the people they serve.

DR. M. E. GROSSMAN

Dr. M. E. Grossman died of cardiac trouble at his home in Honolulu on December 14, 1921 in his sixty-second year. He was one of the most prominent dentists of the Hawaiian Islands, having lived there nearly forty years. He was born in San Francisco, California, October 13, 1859, and went to Honolulu as a young man. He held many positions of honor and trust in his profession, and was a high degree Mason, one of the first potentates of Aloha Temple of the Mystic Shrine, besides having held many other offices in the various Masonic bodies. He was a life member of Delta Sigma Delta Fraternity. Wherever he was known he was universally loved and respected.

He leaves a widow, Mrs. Julia Shepherd Grossman, and two children, Edward S. and Eva. His body was cremated at Nuuanu Cemetery.

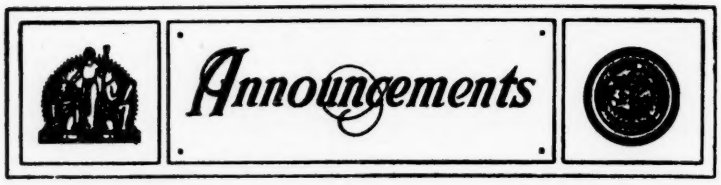
CONFERENCE OF SECRETARIES OF CONSTITUENT STATE ASSOCIATIONS

The conference of the secretaries of the constituent state associations has become an established annual event in the activities of the American Medical Association. These meetings provide opportunities for an exchange of experiences and views and for mutual encouragement in carrying on the organization work in the various state associations and for correlating it with that of the national organization. The freedom of discussion and the spirit of co-operation which characterized the recent conference not only made evident the value of the activities in which the organization is now engaged, but also suggested fields of opportunity for the further development of the services that the organization may render to its members and to the public. The frank, constructive criticism of those who took part in the discus-

sions was full of suggestions which must be reflected in benefits to the individual members. It is a significant fact, and it proves the value of the conference, that there was a full attendance at each of the meetings. —Editorial, *Jour. Amer. Med. Assoc.*, Vol. 77, No. 21.

NOT ON DUTY

I called on Dentist Bacon to have my teeth half-soled; the way said teeth were achin' caused agonies untold, and I by peace forsaken, had feet supremely cold. The office was deserted, no scientist was there; but patients, molar-hurted, reared up to groan and swear, because the dentist flirted with golf and damsels fair. I sought his office daily, thruout a weary week, the while the toothache gayly played tag beneath my cheek; "Oh, woe and willow waly!" I often used to shriek. I hired the village tanner; he, with the plumber's aid, with crowbar and with spanner dug out the teeth decayed, and in a blithesome manner the modest bill I paid. Those business men are silly who close their office doors to seek the golf course silly, and play around outdoors; their customers grow chilly and chase to other stores. I like to play and gambol, the business hours between; I like to take a ramble in my tin limousine; but first I scratch and scramble to earn the good long green. When people seek my dwelling to buy three yards of rhyme, they find me there a-selling my merchandise sublime, my honest bundle swelling by added plunk and dime.— *Walt Mason.*



CALENDAR OF MEETINGS

NATIONAL SOCIETIES

National Dental Association, July 17-21, 1922, Ambassador Hotel, Los Angeles, Cal. Otto U. King, Secretary, 127 N. Dearborn St., Chicago, Ill.

National Society of Denture Prosthetists, July 3-15, Hotel Hayward, Los Angeles, Cal. E. B. Owen, Secretary, 335 Frisco Bldg., St. Louis, Mo.

American Academy of Periodontology, July 10, 11, 1922, Drake Hotel, Chicago, Ill. J. Herbert Wood, Secretary, Cleveland, Ohio.

American Society of Orthodontists, April 24, 25, 26, 1922, Edgewater Beach Hotel, Chicago, Ill. Ralph Waldron, Secretary.

STATE SOCIETIES

February

Minnesota, at Minneapolis (22, 23, 24, 25).

March

Arkansas, at Little Rock (20, 21, 22).
South Dakota, at Sioux Falls.
Texas, at Houston (13, 14).
Vermont, at Burlington (15, 16, 17).

April

Alabama, at Birmingham (11, 12, 13).
Connecticut, at New Haven (20, 21, 22).
Kentucky, at Louisville (10, 11, 12).
Michigan, at Detroit (10, 11, 12).
Mississippi, at Meridian (18, 19, 20).
Pennsylvania, at Pittsburgh (11, 12, 13).
Tri-State—Oklahoma, Kansas and Missouri, at Kansas City, Missouri (10-15).
West Virginia, at Fairmont (10, 11, 12).

May

Illinois, at Springfield (9, 10, 11).
Indiana, at Indianapolis (15, 16, 17, 18).
Iowa, at Des Moines (2, 3, 4).
Louisiana, at Shreveport (8, 9, 10).
Maryland, at Baltimore (2, 3, 4).
Massachusetts, Worcester (2, 3, 4).
Nebraska, at Lincoln.
New Jersey, at Trenton, (3, 4, 5).
New York, at Rochester (11, 12, 13).
North Dakota, at Fargo.
South Carolina, at Georgetown.
Tennessee, at Memphis (8, 9, 10, 11).

June

California (Southern), at Los Angeles.
Colorado, at Colorado Springs (15, 16, 17).
Georgia, at Augusta (14, 15, 16).
New Hampshire, at The Weirs (26, 27, 28).
North Carolina, at Wrightsville Beach (12, 13, 14).
Utah, at Salt Lake City (19-24).
Wyoming, at Sheridan (20, 21, 22).

July

Washington, at Seattle.
Wisconsin, at Milwaukee (11, 12, 13).

September

Delaware, at Wilmington (14).

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Idaho, at Boise, Bureau of License, January 10, and July 11, 1922. Paul Davis, Director, Bureau of License, Boise.

Massachusetts, March 21-24. J. N. Carriere, Secretary, 146 State House, Boston.

Texas, at Dallas, June 19-22. R. L. Rogers Secretary, Amarillo.

Wisconsin, June 19-24. J. L. Blish, Secretary, Fond du Lac.

STUDY CLUBS AND OTHER SOCIETIES

Alumni Association of the Baltimore College of Dental Surgery, May 30 to June 1, 1922, Emerson Hotel, Baltimore, Maryland. Secretary, Norval H. McDonald, 904 N. Charles St., Baltimore, Maryland.

Alumni Society of the Dewey School of Orthodontia, April 27, 28, Edgewater Beach Hotel, Chicago, Illinois. Secretary, George F. Burke, 741-43 David Whitney Bldg., Detroit, Mich.

Dental Hygienist Association of the State of New York, May 12 and 13, Rochester Dental Dispensary.

Southern Society of Orthodontists, March 14 and 15, Piedmont Hotel, Atlanta, Georgia. Secretary, O. A. Oliver, 306 Lambuth Bldg., Nashville, Tenn.

WISCONSIN STATE BOARD OF DENTAL EXAMINERS

The Wisconsin Board of Dental Examiners will hold license examinations for dentists and dental hygienists June 19 to 24, 1922.

J. L. BLISH, *Secretary.*
Fond du Lac, Wis.

TEXAS STATE BOARD OF DENTAL EXAMINERS

The next meeting of the Texas State Board of Dental Examiners will be in Dallas, Texas, June 19-22. For further information, address

R. L. ROGERS, *Secretary,*
Amarillo, Tex.

MASSACHUSETTS BOARD OF DENTAL EXAMINERS

The Massachusetts Board of Dental Examiners will hold a meeting for the examination of candidates on March 21, 22, 23 and 24. Both dental and hygienist candidates will be examined at this meeting. Applications and fees must be filed at the office of the secretary at least ten days before the examination. For full information application blanks, etc., address

J. N. CARRIERE, *Secretary,*
146 State House, Boston, Mass.

SOUTHERN SOCIETY OF ORTHODONTISTS

The next annual meeting of this society will be held on March 14 and 15, at the Piedmont Hotel, Atlanta, Georgia. An exceptionally good program has been outlined, covering a scientific program, including clinics and case reports. All interested in orthodontia are cordially invited to these meetings.

C. C. HOWARD, *President,*
436 Peachtree St., Atlanta, Ga.
O. A. OLIVER, *Secretary,*
306 Lambuth Bldg., Nashville, Tenn.

THE DENTAL HYGIENIST ASSOCIATION OF THE STATE OF NEW YORK

At Rochester, New York, on May 12 and 13 the second annual convention of the Dental Hygienist Association of the State of New York will be held at the Rochester Dental Dispensary in connection with the New York State Dental Society Meeting. All interested are invited to attend. More detailed information will be published later.

VELLA M. STEMPLE.

AMERICAN DENTAL LIBRARY AND MUSEUM ASSOCIATION

The fourth annual meeting of the American Dental Library and Museum Association was held at the Auditorium, Milwaukee, Wisconsin, August 16, 1921. A permanent constitution was adopted and reports show a satisfactory increase in membership. For the benefit of those not acquainted with the association, the object of the organization is to encourage the formation and development of dental libraries and museums, both public and private.

The officers elected for the year 1922-1923 were: president, A. F. Isham, Buffalo, New York; secretary-treasurer, B. W. Weinberger, New York City; executive committee, H. R. C. Wilson, Cleveland, Ohio, Thomas D. Dow, Stanton, Michigan, and E. C. Mills, Columbus, Ohio.

The papers presented and read were: President's Address, by A. F. Isham; "Dental Literature and Libraries; The Function of the American Dental Library and Museum Association," by B. W. Weinberger; "The Private Dental Library," by H. R. C. Wilson.

B. W. WEINBERGER, *Secretary,*
40 E. 41st St. New York, N. Y.

THE NATIONAL ALUMNI ASSOCIATION OF THE BALTIMORE COLLEGE OF DENTAL SURGERY

The National Alumni Association of the Baltimore College of Dental Surgery is planning for a very interesting meeting in Baltimore, May 30, 31, and June 1, as has been previously announced and the various committees are looking forward to a large attendance. Headquarters will be at the Emerson Hotel and Dr. Louis Rossman, 829 Park Avenue, Baltimore, who is chairman of the Reservation Committee, will be very glad to reserve rooms for anyone desiring him to do so. An announcement will be made as soon as possible as to the rates.

NORVAL H. MCDONALD, *Secretary,*
904 N. Charles St., Baltimore, Md.

JOINT CONVENTION OF THE CANADIAN DENTAL ASSOCIATION AND THE ONTARIO DENTAL ASSOCIATION

Joint Convention of the Canadian Dental Association and the Ontario Dental Association will be held May 15 to 19, inclusive, in the King Edward Hotel, Toronto.

E. A. GRANT, *Secretary,*
229 College St., Toronto, Can.

THE TRI-STATE DENTAL MEETING

The Missouri, Kansas and Oklahoma state dental societies will hold a joint meeting in Kansas City, Missouri, April 10-15, 1922. This event promises to be one of the big and important dental meetings of the year. It will be a big meeting because this will be the annual meeting of each of the three state societies. It will be an important meeting because of the subjects on the program and the manner in which they are to be presented.

The "teaching system" will be used almost exclusively. It is not the intention to present many new things but to have a more thoro and better presentation of many of the older things.

The forenoons of four days will be set aside for lectures to the full attendance by the following well-known men of the profession: Arthur D. Black, Chicago, Howard R. Raper, Indianapolis, C. N Johnson, Chicago, Wallace Seccombe, Toronto, Arthur E. Smith, Chicago, M. M House, Indianapolis, Frederick B. Noyes, Chicago, Marcus L. Ward, Ann Arbor. The afternoons of these same days will be devoted to sectional work. The full attendance will be divided into classes and each class will receive an orderly and detailed presentation of the subject under consideration in that section.

The sectional directors are: radiodontia, Clarence O. Simpson, St. Louis; full dentures, Dayton D. Campbell, Kansas City; anchor dentures, Charles Arthur Furrow, Tulsa; root-canal technic, W. A. Chamberlain, St. Louis; pyorrhea and prophylaxis, J. M. Temples, Tulsa; casting technic, E. H. Hart, St. Louis; office efficiency and assistants, C. A. Martin, Winfield; orthodontia, Hugh Tanzey, Kansas City; dietetics in its relation to preventive dentistry, A. L. Walters, Tulsa; crown and bridge-work, W. A. Coston, Topeka; block anesthesia, F. C. Reisling, Tulsa; dental ceramics, J. E. Huff, Kansas City. There will be one day of general clinics by members of the three state societies.

Owing to the fact that the amount of dues collected by most dental societies are just about enough to pay for "janitor services," it will be necessary to collect a very small fee from each person attending this meeting. Members of other state dental societies are most cordially invited to attend this meeting on the same conditions as our own members, viz., he must be a member of his state society with his 1922 dues paid in full. Each person must present his 1922 membership card for registration. These rules will be rigidly enforced. The dental society is the greatest educational factor in our profession; hence the benefits to be derived from attendance at a meeting of the magnitude this one promises to be should make a strong appeal to the members of the profession of this section of the country.

The *Tri-State Dental Bulletin* will be mailed to any one interested in the details of the meeting, upon request to the secretary.

C. R. LAWRENCE, *Secretary-Treasurer*
Enid, Okla,

AUTOMOBILE TRIP FROM SAN FRANCISCO TO LOS ANGELES FOR MEMBERS OF THE NATIONAL DENTAL ASSOCIATION

The dentists of northern California are making plans whereby dentists and their families will be their guests on an automobile trip from San Francisco to Los Angeles, the meeting place of the National Dental Association, July 17-21, 1922. Will all dentists who are planning to accept this kind invitation, which is but another proof of the genial hospitality of the West, kindly send their names to John D. Millikin, Elkan-Gunst Building, San Francisco, before March 1, so that proper transportation arrangements may be made. Requests will be placed in the order of their receipt. For further information address

JOHN D. MILLIKIN
Elkan-Gunst Bldg., San Francisco, Cal.

RESOLUTIONS RELATIVE TO THE DEATH OF DR. MATTHEW HENRY CRYER

WHEREAS, In the death of Dr. Matthew Henry Cryer, the Academy of Stomatology in common with the whole dental profession has suffered an irreparable loss we, his colleagues of the Academy, desire to thus record our recognition of his services to dental science and our appreciation of his high character as our friend and professional associate.

Dr. Cryer was one of the founders of the Academy of Stomatology and was always actively interested in its progress and welfare. Many of his contributions, the results of his original research, were first brought to the attention of the dental world thru the medium of the Academy meetings. As a participant in the discussions of papers his remarks were always those of the constructive critic, the seeker after truth and devoid of the dogmatism of the special pleader. He was thus always a stabilizing influence in directing the debate thru the mazes of error and personal

feeling toward the calm, clear waters of scientific truth.

As an original researcher in the domain of anatomy both human and comparative, his publications record the extent and character of his life-work in a field where his name stands pre-eminent among distinguished coworkers whose reputations are world wide and forever enduring.

As an oral surgeon his attainment places his name beside that of Garretson as the creator and principal exponent of that now well-established and important specialty.

In his professional relationship he was the ideal colleague, the helpful and loyal friend.

We, his fellow-members who thruout the life history of the Academy of Stomatology, have enjoyed the privilege of intimate professional and friendly relationship with him, mourn in the common loss which dental and medical science has sustained in the death of Dr. Cryer. Therefore be it

Resolved, That this expression of our appreciation of his worth and our sorrow at his loss be recorded upon the minutes of the Academy of Stomatology, and that a copy thereof be sent to his family and to the dental journals for publication.

EDWARD C. KIRK, *Chairman*
EDWIN T. DARBY
DANIEL NEALL MCQUILLEN

DENTAL CORPS ORDERS FROM WAR DEPARTMENT.

NAVY

Lieutenant S. M. Akerstrom, Olongapo; to Cavite.

Lieutenant E. A. Jasper, Cavite; to R. S., San Francisco, Cal.

Lieutenant C. V. Rault, marine expeditionary force, Haiti; to navy yard, Philadelphia.

Lieutenant W. H. Wood, navy yard, Boston, Mass.; revocation appointment.—*Army and Navy Register*, January 7, 1922.

Lieutenant Commander J. W. Crandall, navy yard, Philadelphia, Pa.; to marine expeditionary force, Santo Domingo.

Lieutenant Commander A. F. McCreary, marine expeditionary force, Santo Domingo; to naval training station, Hampton Roads, Va.

Lieutenant W. C. Carroll, marine baracks, Quantico, Va.; to marine expeditionary force, Port-au-Prince, Haiti.

Lieutenant W. F. Hawthorn, naval dispensary, Washington, D. C.; resignation accepted.

Lieutenant P. H. MacInnis, Camden; to navy yard, Portsmouth, N. H.

Lieutenant Fred A. Batkin, Beaver; to R. S., San Francisco, Cal.

Lieutenant A. R. Gleitsman, St. Louis; to Shawmut.—*Army and Navy Register*, January 14, 1922.

Lieutenant Commander L. C. Williams, Alert; to Eagle 11.

Lieutenant (J. G.) H. J. Hill, Alert; to Eagle 11.

Lieutenant Commander R. C. Green, advance base force, U. S. marines, San Diego, Cal.; to Prairie.

Lieutenant C. H. Webber, Prairie; to advance base force, U. S. marines, San Diego, Cal.

The following promotions in the Navy are announced: To be dental surgeons: H. D. Johnson, P. G. White and G. H. Reed. To be passed assistant dental surgeons: C. C. Tinsley, H. L. Kalen and P. H. MacInnis.—*Army and Navy Register*, January 21, 1922.

ARMY

Captain Clarence J. Wright, having been found by an Army retiring board incapacitated for active service on account of disability incident thereto, his retirement from active service is announced; proceed home.

Captain Francis M. Tench from duty at Fort Hancock, N. J., to Walter Reed General Hospital, D. C., for duty.—*Army and Navy Register*, December 31, 1921.

Lieutenant Col. John R. Ames to duty at station hospital, Fort Sam Houston, Tex.

Resignation by First Lieutenant Leon A. Jones accepted.—*Army and Navy Register*, January 7, 1922.

Colonel S. Davis Boak, in addition to present duties, will report at Walter Reed General Hospital, D. C., for duty as commandant Army Dental School.

Major John L. Schock upon arrival in United States to Letterman General Hospital, Presidio of San Francisco, for duty.

Major Dale E. Repp, now on leave at Portsmouth, Va., at his own request, is relieved from duty at Letterman General Hospital, San Francisco, and will report at Camp Meade, Md., for duty.—*Army and Navy Register*, January 14, 1922.

Captain Oliver J. Christiansen from present duties at Camp Meade, Md., and will report at tank center, that camp, for duty.

Captain Campbell H. Glascock from duty at Camp Pike, Ark., to Camp Knox, Ky., for duty.

Lieutenant Colonel George D. Graham (R. C.) from Fort Howard, Md., to 3d corps area.

The following promotion in the Dental Corps of the Regular Army is announced: A. B. McCormick to be captain from January 1, 1922.

The following appointments in the Dental

Corps were made by transfer in the Regular Army: Captain C. C. Olson from January 10, 1922. C. O. Purdy, chaplain, captain, from January 5.—*Army and Navy Register*, January 21, 1922.

Public Health Service

Passed Assistant Dental Surgeon William D. Lanier, reserve, relieved from hospital No. 32, Washington; assigned to Las Animas, Colo.

A. A. Dental Surgeons L. A. Cummings and H. G. Wyatt, to hospital No. 76, Maywood, Ill., for duty in dental clinic.

A. A. Dental Surgeon L. M. Cantor to hospital No. 141, New Haven.—*Army and Navy Register*, December 31, 1921.

A. A. Dental Surgeon L. G. McAloney to No. 77, Portland, Oregon.

A. A. Dental Surgeon P. O. Fallon relieved from out-patient dental clinic, Washington, and to hospital No. 36, Boston.—*Army and Navy Register*, January 7, 1922.

The following applicants have accepted appointments in the Dental Reserve Corps: Captain C. F. Stekl, Baraboo, Wis.; First Lieutenant B. W. Wells, Evart, Mich.

Army Dental School

The newly established Army dental school at Walter Reed Hospital held its opening exercises on Monday afternoon, when the first class of eighteen student officers of the dental corps were addressed by General Ireland, General McCaw and Colonel R. T. Oliver. Colonel S. D. Boak is the commandant of this institution.

PATENTS OF INTEREST TO DENTISTS

1389624, Toothbrush, Charles E. Carroll, Newport, Ark.

1389662, Means of treatment of pyorrhea, John R. Irwin, Cohourg, Canada.

1389954, Dental tool for extracting lower molars, George F. McCombs, Connersville, Ind.

1389956, Retainer for the closure-caps of collapsible tubes, Davis Marinsky, New York, N. Y.

58989, Design, panel for dental appliances, Oscar H. Pieper and A. F. Pieper, Rochester, N. Y.

1390353, Artificial tooth, Thomas Flintoff, Claremont, Australia.

1390354, Dental appliance, Julius Fried, New York, N. Y.

1390553, Toothpick dispenser, Hiram S. Hearn, and A. E. Perreton, Denver, Colo.

1391651, Artificial tooth, Francis Carlin, Belfast, Ireland.

1391459, Toothbrush, Hyman F. Chaiken, Reading, Pa.

1391535, Dental impression tray, Albert M. Epstein, Elmira, N. Y.

59127, Design, toothbrush, Joseph E. Perrault, Northampton, Mass.

1391906, Dental engine handpiece, Will R. Porter, Prince Bay, N. Y.

1392285, Toothbrush, Sidney Sprague, Ossining, N. Y.

1392085, Syringe, Frederick W. Stanton, Chicago, Ill.

1392612, Palatal bar, Hugo Aderer, East Orange, N. J.

1392824, Dental bridge, Joseph B. Foster, Roanoke, Va.

1392784, Clasp for teeth, Edmund R. Nebeling, New York, N. Y.

59230, Design, dental implement, John H. Kellogg, Battle Creek, Mich.

1392919, Metallic-denture drawing die, Robert M. Craig, Wilkinsburg, Pa.

1393108, Daylight X-ray film developing tank, John B. Garrett, Troy, N. Y.

1393120, Dental engine, George D. Heck, Prince Bay, N. Y.

1392944, Sterilizer, Albert H. Jessup, Erie, Pa.

1393166, Hollow metal crown for artificial teeth, Jean L. P. Roumeguere, Auch, France.

1394143, X-ray apparatus, William D. Coolidge, Schenectady, N. Y.

1394144, Incandescent cathode apparatus, William D. Coolidge, Schenectady, N. Y., and E. A. Wagner, Fort Wayne, Ind.

1394145, Thermionic discharge apparatus, William D. Coolidge, Schenectady, N. Y.

1393767, Dental bridge construction, Leo E. Evslin, New York, N. Y.

1394299, Attaching means for artificial teeth, Joseph B. Foster, Roanoke, Va.

1394171, Electric needle, Mary E. Hall, Chicago, Ill.

1394322, Hydrometer syringe, Herbert S. Marshutz, New York, N. Y.

1394503, Dental X-ray packet, Raymond R. Taylor, Rochester, N. Y.

1394391, Dental cotton holder and waste receiver, Nicholas I. Woolsey, New York, N. Y.

1394913, Headrest for barber or like chairs, Giuseppe C. Laraia, New York, N. Y.

1394569, Increasing the efficiency of X-ray tubes, William Meyer, Chicago, Ill.

1395235, Dental amalgam or alloy mixer, Bohuslav Siml, Chicago, Ill.

1394770, Horizontally-split attachment for removable dental bridge-work, John Yirikian, New York, N. Y.

Copies of above-mentioned patents may be obtained for twenty-five cents each, by addressing John A. Saul, Solicitor of Patents, Fendall Building, Washington, D. C.

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